ELECTRICAL WORLD

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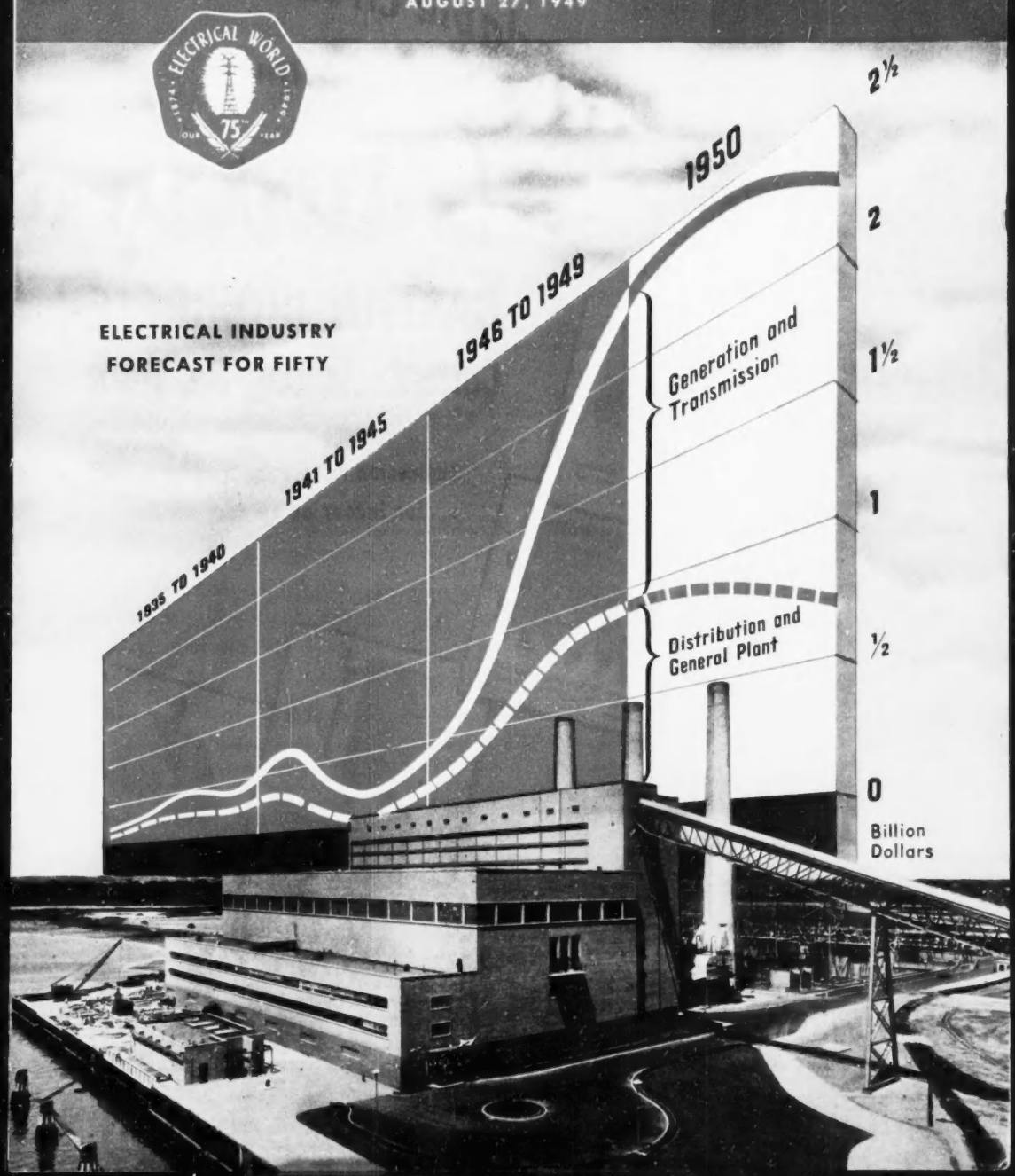
AUGUST 27, 1949



Year After Year

You Can Count On

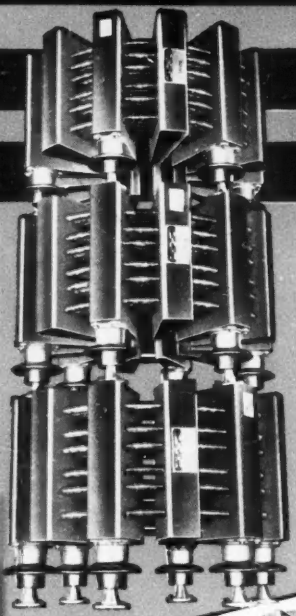
Dependable Circuit Protection

WITH

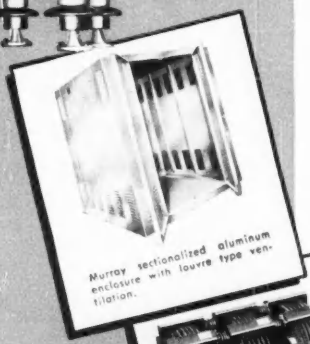
Murray

CAST-IN-CONCRETE
Current-Limiting Reactors

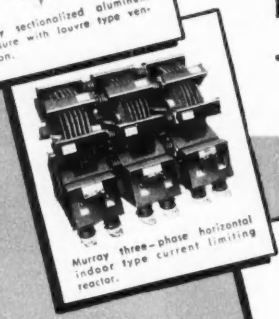
Engineered to your specifications...
...for indoor or outdoor service.



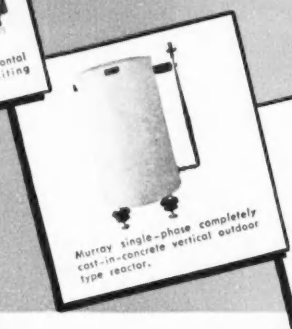
Typical Murray three-phase vertical outdoor type cast-in-concrete current limiting reactor.



Murray sectionalized aluminum enclosure with louvre type ventilation.



Murray three-phase horizontal indoor type current limiting reactor.



Murray single-phase completely cast-in-concrete vertical outdoor type reactor.

Murray pole top reactor.

Feeder
Generator
Motor Starting
Neutral Grounding
Transformer Equalizing
Special Purpose
Station Tie
Bus Tie
Shunt
} Reactors

To help you give detailed information on reactors for your individual application, this comprehensive folder has been especially prepared. It provides a reliable guide to points to check in specifying all types of cast-in-concrete current limiting reactors. Write Murray for your copy today.

Murray

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50 Years of Service to the Electrical Industry

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SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS NEST AERIAL LADDERS

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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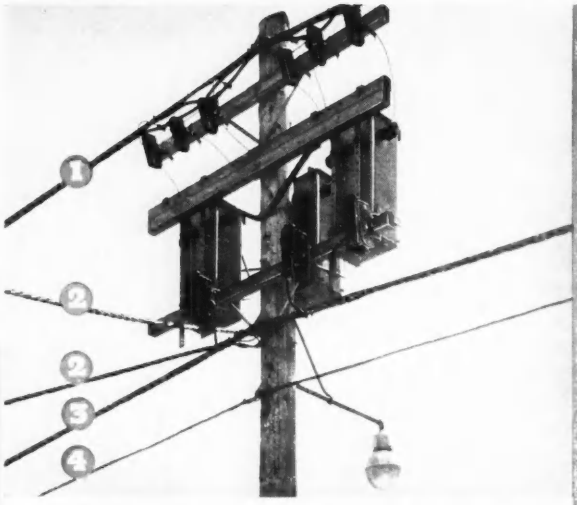
4 applications for OKOLITE-OKOPRENE *aerial cables*

. . . with these 16 advantages



1—PRIMARIES 2—SERVICES 3—SECONDARIES 4—LIGHTING CIRCUITS—all on one pole at Bonneville, Oregon.

- Most utility engineers now recognize the advantages of aerial cables for primary circuits. Moreover, many are now using this economical cable design for street lighting circuits, for secondaries — including networks — as well as for service drops. For such installations, time-proved Okolite-Okoprene aerial cables — whether self-supporting, ring-supported or spinner-lashed — offer many advantages.

The patented Dualay* assembly, originally designed by Okonite engineers for hot-tapping of Okolite-Okoprene self-supporting primary cables, is also of distinct value for secondary circuits, since services can be taken off at any point, even in mid-span, without racks or spreaders.

In addition to their suitability for utility overhead systems, Okolite-Okoprene aerial cables are extensively used by industrial plants and railroads for power, lighting, communication and control systems. Details on the many types available, with complete data on selection and installation, are available in Bulletin EW-1033. The Okonite Company, Passaic, N. J.

*In the Dualay method (U.S. Pat. 2,430,378) the insulated conductors are twisted together so that the direction of lay is reversed at regular short intervals to permit conductor separation without cutting the copper or performing any operation on the messenger.

- Improved circuit regulation and lower voltage drop through lower reactance.
- Tree trimming reduced or eliminated.
- Overlength poles not needed to clear treetops.
- Fewer service interruptions or outages.
- Reasonable original cost.
- Lower maintenance cost.
- Simple to install.
- Higher safety factor for linemen, people and property.
- Good appearance.
- No festooning.
- Long spans.
- Less congestion on poles.
- Elimination of cross-arms.
- Reduced clearance space near buildings and other structures.
- Greater reliability in storms—resist wind, icing, moisture—operate even if poles are down.
- Messenger serves as neutral.

Okolite-Okoprene *Self-Supporting* Aerial Cable with in-built messenger. Made with Dualay* design for easy tapping.

Okolite-Okoprene cables can be lashed to messenger by the *spinner method.*

Okolite-Okoprene cables may be installed in regular *messenger rings.*

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7689

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Rainier crossarms, stocked by Graybar, have proven strength and long-life in service. Made from expertly chosen timber, scientifically seasoned to prevent fungi growth.

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Graybar has first-quality steel or wood crossarm braces, wood X-braces, and wood knee braces – all the sizes you require.

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Graybar warehouse stocks of hundreds of pole-line items now are maintained in over one hundred cities and we can deliver promptly from these stocks the many items you know and prefer. Your Graybar Representative gladly gives you information about anything "from the bottom of the hole to the top of the pole." A Graybar Outside Construction Specialist can help you solve any problem of line construction design or materials.

Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.

4213-1

IN OVER 100 PRINCIPAL CITIES

HOW LONG?

Ever since 1935 when the first Simplex-ANHYDREX rubber-jacketed cables were put on the market, they have shown themselves to be remarkably free from trouble. Not once in all that time has an ANHYDREX Cable failed because of water absorption. That's why we can't give an adequate idea of the length of service you can expect from ANHYDREX Cable.

But accelerated aging tests constantly carried on by the Simplex Laboratories give us good reason to predict that their service life will be long and trouble-free.

Tests for mechanical water absorption prove that during 7 days' immersion at 70° C. (158° F.) Anhydrex insulation absolutely will not absorb more than 20 mg. of water per square inch of exposed surface.

Tests for electrical stability in water show that after one day's immersion at 70° C. Anhydrex has a dielectric constant that will not exceed 3.2. Its increase in capacitance between one and eight days' immersion at 70° C. will not exceed 3.5% for insulation thicknesses greater than 4/64" or 5% for thicknesses of 4/64" and less.

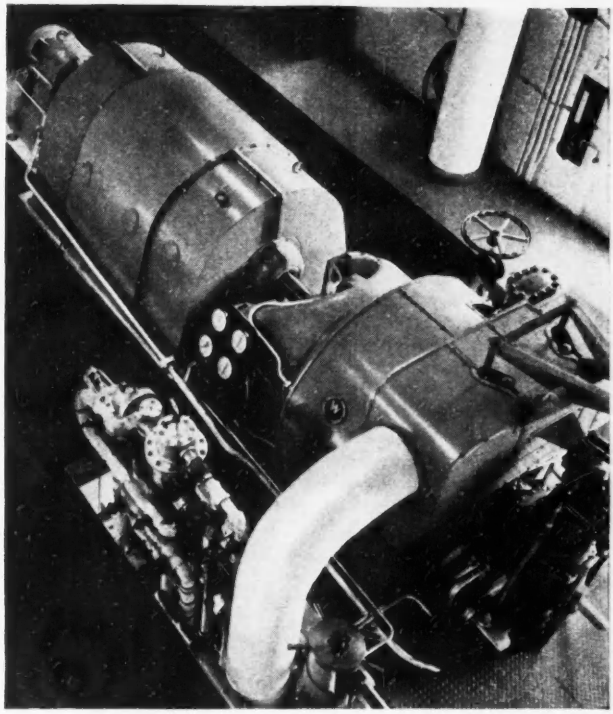
Physically too, ANHYDREX Cables are tops. Their tough neoprene jacket stands up under year-in, year-out exposure to soil acids and alkalies and is fully able to withstand all manner of rough handling. If you run your cables up above ground you'll find it provides positive protection against weather hazards, sunlight and heat.

Performances in the field back up the story our lab tests tell. Why not discover, yourself, just what these figures can mean? . . . They're easily translated into added years of service per cable plus worthwhile savings for you.

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

FULLY PROTECTED AGAINST RUST, SLUDGE, FOAM



...when you use world-famous Texaco Regal Oils (R & O). They keep systems clean.

TEXACO *Regal Oils* (*R & O*) are highly refined from selected base stocks—give extra long service life. They are fortified at the refinery with powerful rust and oxidation inhibitors, and special processing gives them effective anti-foaming properties. They keep circulating systems clean, protect bearings, keep governor action smooth and instantly responsive.

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Let a Texaco Lubrication Engineer help you obtain greater efficiency and economy in the operation of all your plant equipment. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N.Y.

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FOR ALL TURBINES

6 Ways to Look

IMPORTANT DETAILS MAKE THE DIFFERENCE IN ALLIS-CHALMERS UNIT SUBS

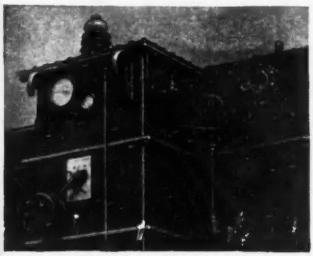
MANY DETAIL IMPROVEMENTS in unit substations have been pioneered by Allis-Chalmers: controlled gasket compression, protective *Oil-Sealed* inert gas system, "quick-break" contact separation, finger-type disconnects, no-corona taped bus joints, flexible drop collar throat, and others.

Together such improvements make up the real difference between superior and average performance. They are good points to look for, and compare, when purchasing unit substations for your distribution system.

±10% Regulation Results in Added Savings

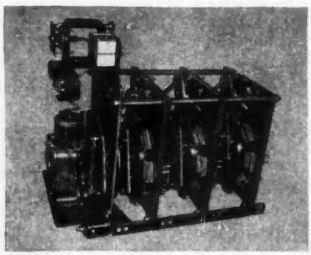
Allis-Chalmers unit substations cost less because of standardization on one range. This reduces your cost because the savings in engineering and manufacturing have been passed along to you. ±10% range was chosen since it fits most utility requirements and permits more load than ±7½%.

Call in your nearby A-C representative and have him go over the advantages you get with Allis-Chalmers unit substations. Or write direct.



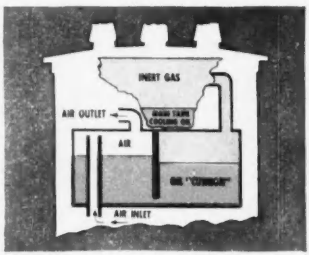
1. *SAFETY*

NO-LOAD TAP CHANGER on side of tank protects operator from accidental contact with overhead high voltage lines. Other safety features include: dead-front panels; interlocks; vertical lift breakers; drawout potential and control power transformers. Protects your operators, your equipment and your service.



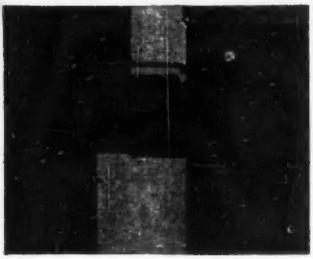
2. *REGULATION*

±10% RANGE is adequate for virtually any distribution substation. The narrow ⅝% steps of the tap-changing mechanism keep voltage fluctuations to a minimum. Oversize contacts and snap action minimize contact burning. Sturdy mechanism and motor operate in oil for maximum life.



3. *MAINTENANCE*

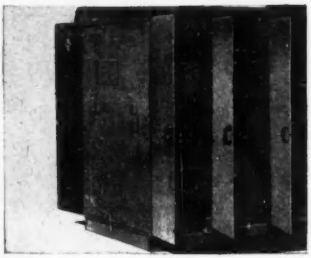
OIL-SEALED inert gas system uses no valves or external gas supply — reduces maintenance to routine gage readings. There are no external gas bottles to replenish, no waste gas. This system operates at pressures usually less than a pound . . . minimizing chance for gas leakage through gasketed joints.



4. *INSTALLATION*

DROP COLLAR throat saves time and money in preparing foundations. There is no need for exact alignment between transformer and switchgear because flexible connectors are used.

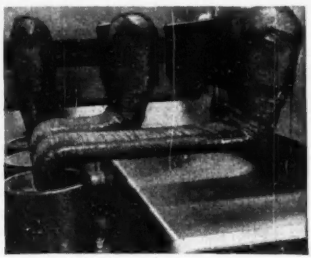
Switchgear units are shipped in groups as large as can be conveniently handled at the installation site.



5. *ACCESSIBILITY*

SWITCHGEAR HOUSING has doors front and rear permitting easy access to breakers; current, potential and control transformers; fuses.

Feather-Touch control for tap changer is in accessible cabinet. A transparent plastic cover for the voltage integrator permits inspection without breaking dust-tight seal.



6. *FLEXIBILITY*

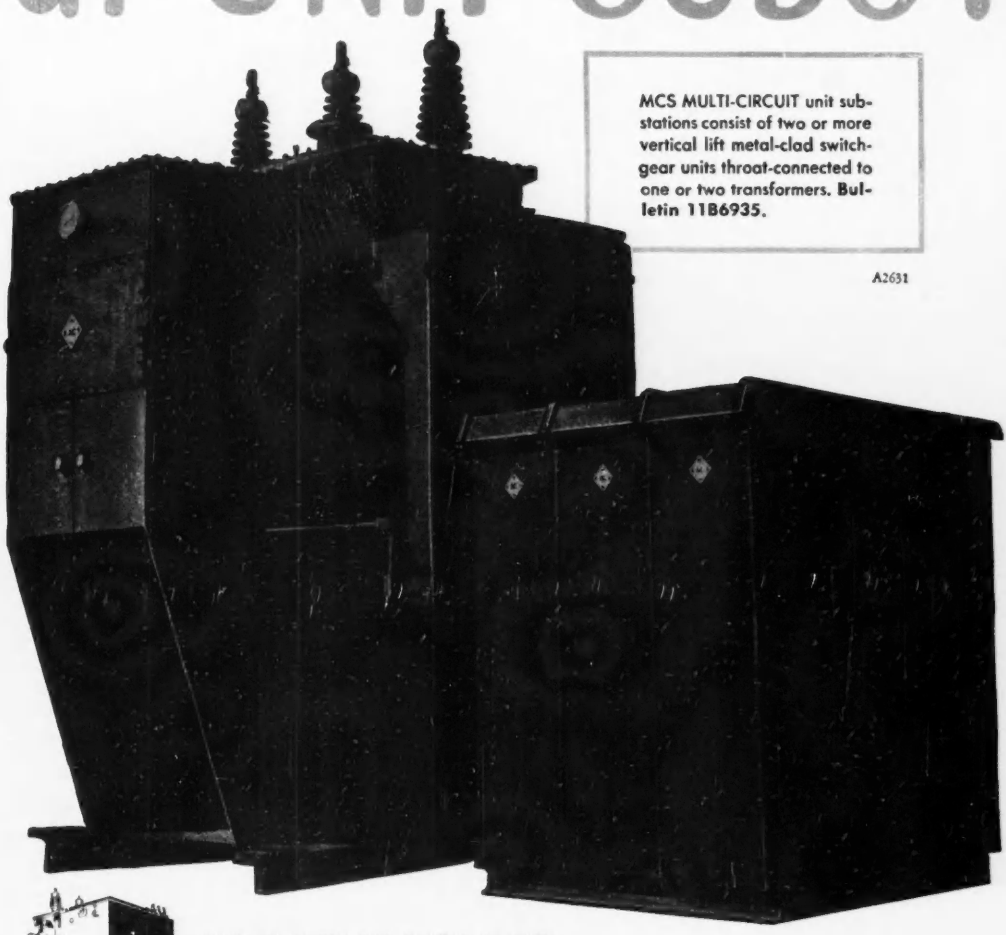
TAPED AND BOLTED connections reduce time and trouble involved in changing connections. No time is lost preparing compound in the field or filling connection boxes.

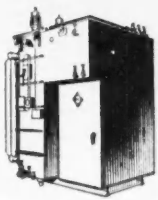
Standardized construction simplifies the addition of new switchgear units when more circuits are needed.

at UNIT SUBS!

MCS MULTI-CIRCUIT unit substations consist of two or more vertical lift metal-clad switchgear units throat-connected to one or two transformers. Bulletin 11B6935.

A2631





ALLIS-CHALMERS SCS SINGLE CIRCUIT unit substations consist of a transformer, secondary breaker and control, *Oil-Sealed* inert gas system for protecting oil, and the 32 5/8% step regulator mechanism for ±10% range of regulation — all combined within a single housing. They can be installed as a unit.

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.

Feather-Touch and *Oil-Sealed* are Allis-Chalmers trademarks

ALLIS-CHALMERS

Pioneers in Load Ratio Control — Originators of 5/8% Step Regulation

CUT POLE-TOP SWITCH COSTS!

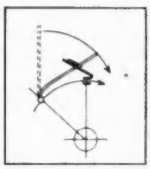
DEAD-END CONDUCTORS *DIRECT* TO NEW KPF TYPE "A" SWITCHES!

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

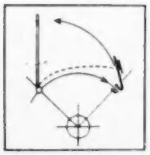
THE SPLIT-SECOND BREAKING SPEED of this new KPF Quick-Break Attachment means you can now switch many high-voltage circuits without employing expensive circuit breakers.

This new attachment is already in use opening 60 kv loops with loads up to 12,000 kva; in switching 1080 kva, 11 kv capacitor banks; and in other applications including the dropping of 32 miles of 69 kv line.

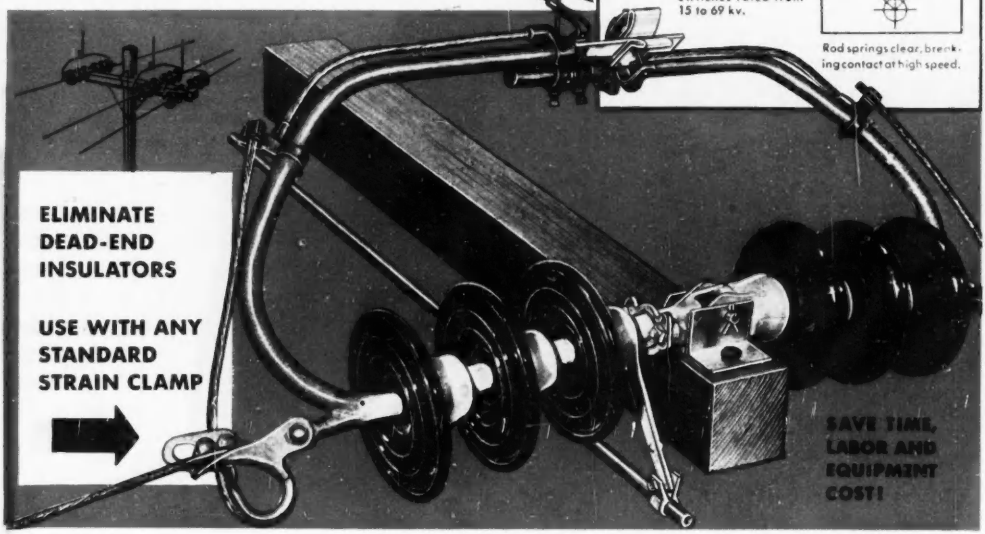
The KPF Quick-Break Attachment fills the gap between simple disconnects and expensive circuit breakers. It is available for all KPF switches rated from 15 to 69 kv.



Spring rod winds to full tension as switch opens.



Rod springs clear, breaking contact at high speed.



DEAD-END LINES HOT to these new KPF Type "A" Pole Top Switches—and save! Eliminate dead-end insulators; use any type of standard strain clamp!

KPF Type "A" Switches are simple in design, ruggedly constructed, and easy to install. They consist of two insulator stacks with a bearing assembly that permits stacks to be adjusted to normal line sag. Patented, free-floating, self-aligning contacts maintain proper contacts under any conditions of switch sag adjustment. Switch arms and dead-end eye are integral with the insulator assembly. The forged dead-end eye is of standard dimensions, so it will accommodate standard strain clamps. This makes for faster, more convenient hot line installation. The interphase control is of the push-pull type, which means that switch operation is unaffected by cross-arm warpage—even after long periods of idleness.

KPF air-break switches have been proven in thousands of applications during the past 40 years.

KPF

FIND OUT HOW KPF TYPE "A" SWITCHES CAN SAVE FOR YOU! WRITE TODAY FOR DETAILS!

ELECTRIC COMPANY · 855 Howard Street · San Francisco 3, California

FOR GREATER SAFETY . . .

LOWER RESISTANCE . . .

RUST-PROOF PROTECTION

Only Copperweld Ground Rods Are Stamped "Copperweld"— The Mark Of Permanent Grounding Protection →

Copperweld
TRADE MARK

GROUND RODS AND CLAMPS

Over a 25-year period, Copperweld* Ground Rods and Clamps have provided increased safety for persons and equipment and have proved their superiority in service wherever driven ground electrodes are required. These practical features are sound reasons why millions of Copperweld Ground Rods and Clamps are giving permanent grounding protection:

1. **Molten-Welded**—Perfect interlocking weld between the copper and alloy steel eliminates possibility of electrolytic action. No other ground rod has this unique Molten-Welded feature.
2. **Extra Strength**—Rugged core of alloy steel is stronger—tougher—stiffer. Easy driving is assured.
3. **High Conductivity**—Thick sheath of pure copper provides high electrical conductance. Copper-to-copper contacts throughout eliminate high resistance connections.
4. **Non-Corrosive**—Rust-proof, thick copper covering permanently protects alloy steel core against corrosion.
5. **Overall Economy**—Long service life with no maintenance costs. Safe, sure, permanent grounding protection for all types of installations.

Consider these advantages in relation to your own grounding requirements—then plan to standardize on ground rods that are stamped "Copperweld." For Engineering Data, write for Bulletin E.D. 375.

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COPPERWELD STEEL COMPANY

GLASSPORT, PA.

**Trade Mark*

Copperweld TRADE MARK **GROUND RODS AND CLAMPS**

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Rome's *IMPROVED* SERVICE CABLES

GIVE YOU MANY PRACTICAL ADVANTAGES *AT NO EXTRA COST*

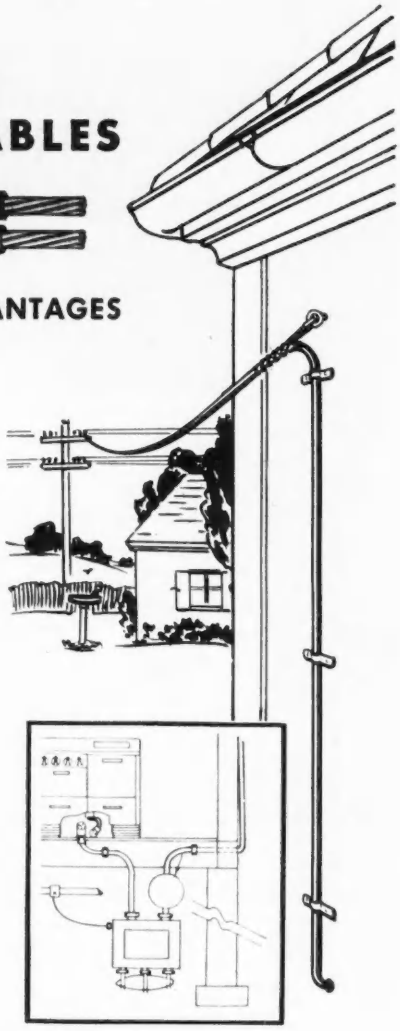
Yes, Rome's improved Service Entrance (Type SE) and Service Drop (Type SD) Cables are now constructed to provide many desirable features for this class of service . . . *at no extra cost.*

For one thing, an improved interlocking braid is applied over the rubber insulated conductors. There is a new, clean inner construction providing easy identification of color-coded conductors and a brightly tinned concentric conductor for easy connections. Wrapped over the concentric is a special moisture-resistant tape, making an effective "water seal" against atmospheric moisture. Further, the conventional outer braid of cotton has been replaced with a non-rotting and non-wicking combination of glass and presaturated yarns. Finally, the non-marring, moisture and flame-retarding gray paint finish can be repainted to match any color desired.

Here, then, is a Service Cable that is non-fraying and non-festooning for longer life and neater appearance . . . is non-wicking and sealed against moisture . . . is clean and easy to handle . . . has improved edgewise bending because the new construction permits conductors to slide easily.

Rome Service Drop (Type SD) and Service Entrance (Type SE) Cables are fully approved by Underwriters' Laboratories, Inc. Further, under conditions of the National Electrical Code, Service Entrance (Type SE) may be used as a single cable directly from pole to meter—as well as for electric range and domestic water heater feeder services. Thus, there is the added advantage of a *single* cable for complete service entrance.

It will pay you to make sure that your next Service Cable requirements are filled by Rome Cable. You are assured of high quality workmanship predicated upon sound engineering. Available in two and three conductor constructions.



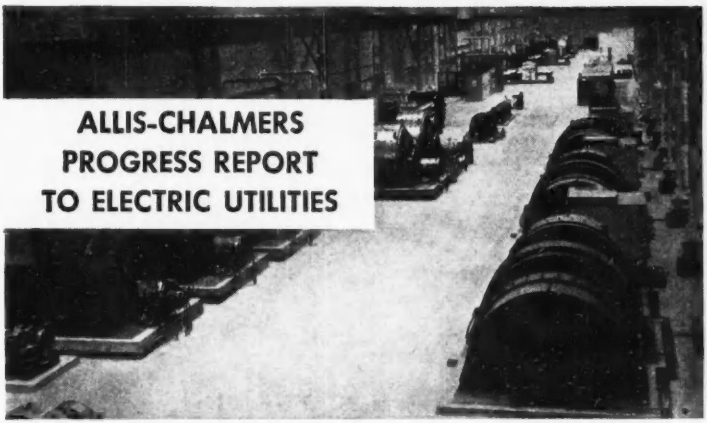
FROM POLE TO METER . . TO RANGE OUTLET . . . WITH SERVICE ENTRANCE—TYPE SE, STYLE U

It costs no more to buy the best . . . Specify Rome Cable

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK



ALLIS-CHALMERS PROGRESS REPORT TO ELECTRIC UTILITIES

43,800 HP ROLLING STEEL! Typical of A-C Power, Electrical, Processing equipment

Load-Building, Cost-Cutting A-C Products

H. A. Bartling
Mgr. Electronics

DURING THE PAST YEAR A-C advanced production not only in electric power equipment, but in actual electric load-building equipment as well.

MOTORS. New, protected general purpose motors in drip-proof and totally-enclosed types are now offered to industry in sizes from ½ through 20 hp. New tube-type TEFC and explosion-proof motors from 75 through several thousand hp have been marketed for powerhouse, chemical and petroleum needs. Improved maintenance, protection are stressed.

STARTERS. The line has been expanded to meet practically all requirements from the smallest manually-operated across-the-line starters to the largest high capacity units. You can now get an Allis-Chalmers starter for *any* size motor!

ELECTRONIC EQUIPMENT. Allis-Chalmers Induction and Dielectric Heaters, and Metal Detectors, widest line in industry, are helping users cut unit costs, improve products, protect quality.

BETATRONS. A-C has opened the world's first commercial betatron laboratory, providing open time for high-speed radiography and research. Five 24,000,000 volt betatrons have been shipped for medical, and nuclear research.

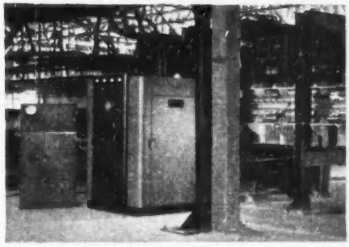
NEW CAR SHAKER. Introduced for power plants and industries requiring fast unloading of frozen coal or other materials from hopper-bottom cars.

On the equipment side, utilizing electric power, emphasis has been on mechanization—more A-C crushers, hoists, screens, huge steel mill motors, shakeouts. In cement, A-C rotary kilns, long as 475', are electric-powered. A new petroleum pipe line will use 29 A-C tube-type motors. In public works, huge A-C pumps from 5 to 21 mgd, are being installed. In pulp and paper a total of 16,000 hp of motors, a 170' kiln and 46 pumps are going into one plant! These examples are typical.

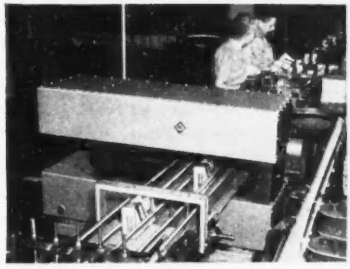
Building equipment for . . . and promoting applications of . . . *electric power* is the No. 1 job of the General Machinery Division of Allis-Chalmers! Over 65 years in electrical equipment, 102 years in industrial, are concrete evidence of Allis-Chalmers' stake in the Electric Power Industry! ALLIS-CHALMERS, 932A S. 70TH ST., MILWAUKEE 1, WIS.

A2722

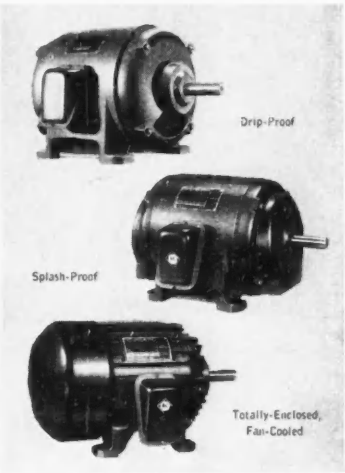
HIGH PRODUCTION 20-kw induction heater



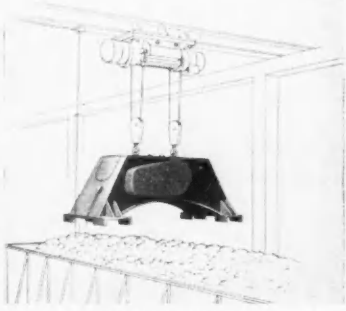
15-KW DIELECTRIC heater for wood-gluing



METAL-DETECTOR safeguards consumer products



"SAFETY-CIRCLE" MOTORS—more protection



ELECTRIC-POWERED car shaker loosens coal, etc.

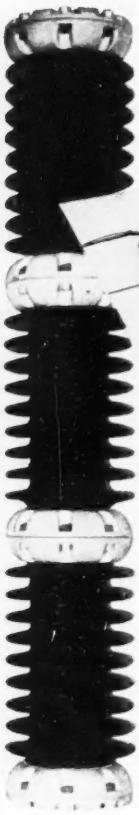
Safety-Circle is an Allis-Chalmers Trademark

ALLIS-CHALMERS A-C

Pioneers in Power and Electrical Equipment—Builders of the World's Widest Range of Major Industrial Equipment!

115 kv

161 kv



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. . . MECHANICAL SECURITY

. . . LONG LIFE

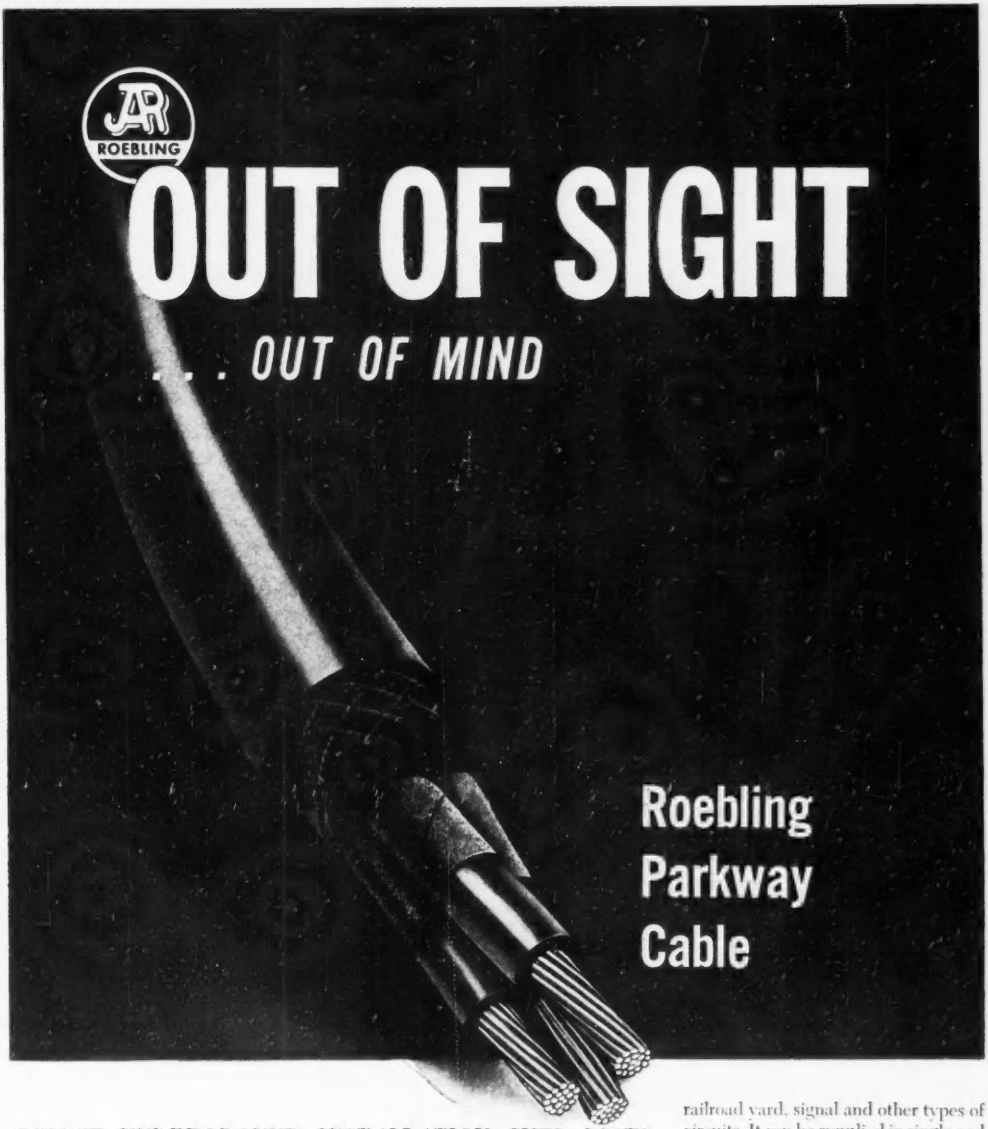
. . . GOOD LOOKS . . .

LAPP STATION POSTS

For rigidity . . . for permanence . . . for superior performance under arcover . . . for elimination of puncture and cracking . . . for better operating characteristics under atmospheric contamination . . . Lapp Post insulators offer a record of proved advantage. For new construction or maintenance of stations at all voltages up to, and including, 161 Kv, these units are the logical 1949 specification.

Lapp STATION POSTS

LAPP INSULATOR CO., INC. • LE ROY, N.Y., U. S. A.



DIRECT UNDERGROUND INSTALLATION CUTS COSTS

YOU AVOID ALL THE EXPENSE of underground duct systems with Roebling Parkway Cable. It's laid directly in an economical two- or three-foot trench. And as soon as it's out of sight, your problems are over. Wind and weather can't bring service troubles . . . metallic armor or a non-metallic Roeprene sheath assures safe physical protection.

Roebling Parkway Cable is being widely adopted for series street lighting, parkway boulevard lighting, traffic signal, fire alarm, flood lighting, railroad yard, signal and other types of circuits. It can be supplied in single and multiple conductor types—either solid or stranded—in a range from 600 to 5000 volts.

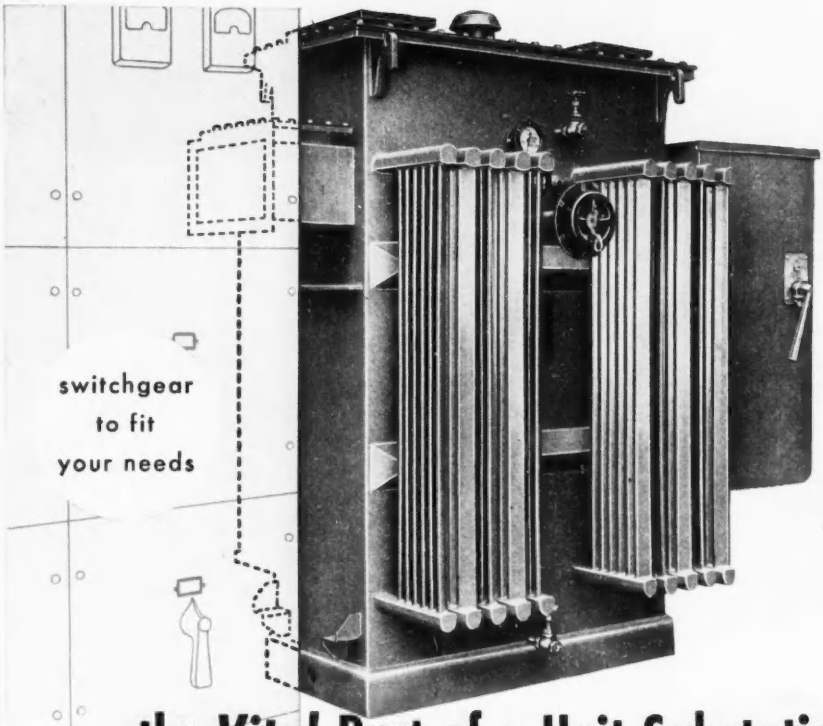
Have your Roebling distributor or Roebling branch office help select the best cable for your special needs. John A. Roebling's Sons Company, Trenton 2, New Jersey.

WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ ***Boston***, 51 Sleeper St. ★ ***Chicago***, 5525 W. Roosevelt Rd. ★ ***Cleveland***, 701 St. Clair Ave., N. E. ★ ***Denver***, 1635 17th St. ★ ***Houston***, 6216 Navigation Blvd. ★ ***Los Angeles***, 216 S. Alameda St. ★ ***New York***, 19 Rector St. ★ ***Philadelphia***, 12 S. 12th St. ★ ***Pittsburgh***, 355 W. North Ave. ★ ***Portland, Ore.***, 1032 N. W. 14th Ave. ★ ***San Francisco***, 1740 17th St. ★ ***Seattle***, 900 First Ave.

ROEBLING

☆ *A CENTURY OF CONFIDENCE* ☆



the *Vital* Part of a Unit Substation is the Transformer

• Wagner Unit Substation Transformers can be Throat Connected to any make of Switchgear...**The transformer is** the vital part—the fuel pump—of a load center distribution system. If the transformer fails, the entire system is dead, whereas only part of the distribution system may be affected by the failure of a switch or circuit breaker.

You can be sure of a dependable continuous flow of power from a Wagner transformer and you can be sure that it has been carefully designed to meet your distribution requirements.

Wagner unit substation transformers with incoming high voltage switch sections to meet your requirements, and, with proper throats on the secondary side for connection to any make of switch-gear, are available in the usual range of ratings up to 2000 kva. Our factory-trained sales engineers are well qualified to recommend the various combinations necessary to handle your unit substation requirements and will gladly give you immediate service.

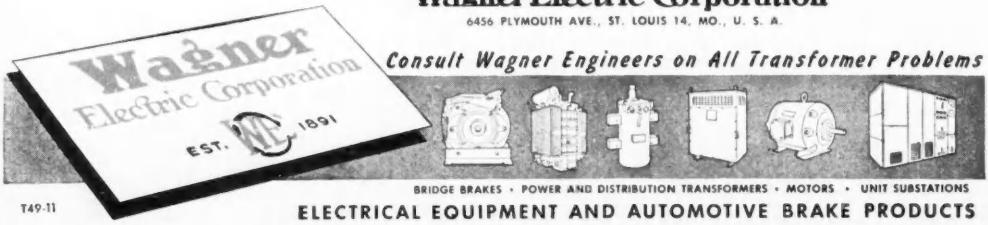
Wagner unit substation transformers are installed in numerous electric generating stations and in all kinds of industrial plants including synthetic rubber, petroleum, steel, chemical, aircraft, automotive, paper, and many others. The importance of the transformer in a unit substation justifies calling in the Wagner sales engineer to help solve all your load center problems.

Our free bulletins TU-13 and TU-56 describe the design and construction features that make Wagner liquid-filled and dry-type unit substation transformers outstanding.

Wagner Electric Corporation

6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

T49-11

LIGHTNING can and does strike at unpredictable times and places. When it does, protection to life and property and the correct functioning of electrical equipment depend largely on suitable and permanent ground connections—connections that are maintained in a condition to perform the service for which they were designed and installed.

Make sure that your grounds have adequately-low resistance through the periodic use of a "Megger*" Ground Tester. Available in two models, these instruments measure resistance to earth of ground connections quickly, easily and accurately.

THE HEAVY DUTY "MEGGER" TYPE—built for ruggedness and durability—housed in a teakwood case. Has proportionately divided scales from 0 to 1 ohm (reading in .01 ohm) to as high as 0 to 30,000 ohms, with three, four or five ranges in the same instrument.

THE "MEG" TYPE—smaller and lighter, weighing only 8 pounds—mounted in a cast aluminum case. Scales are logarithmic in character, so as to cover as wide a range as possible within the limits of practical field accuracy. Ranges are single or double up to 3,000 ohms.

For a complete description of "Megger" Ground Testers and the "hows" and "whys" of ground resistance measurement, we invite you to write NOW for Catalog 25-W

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JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

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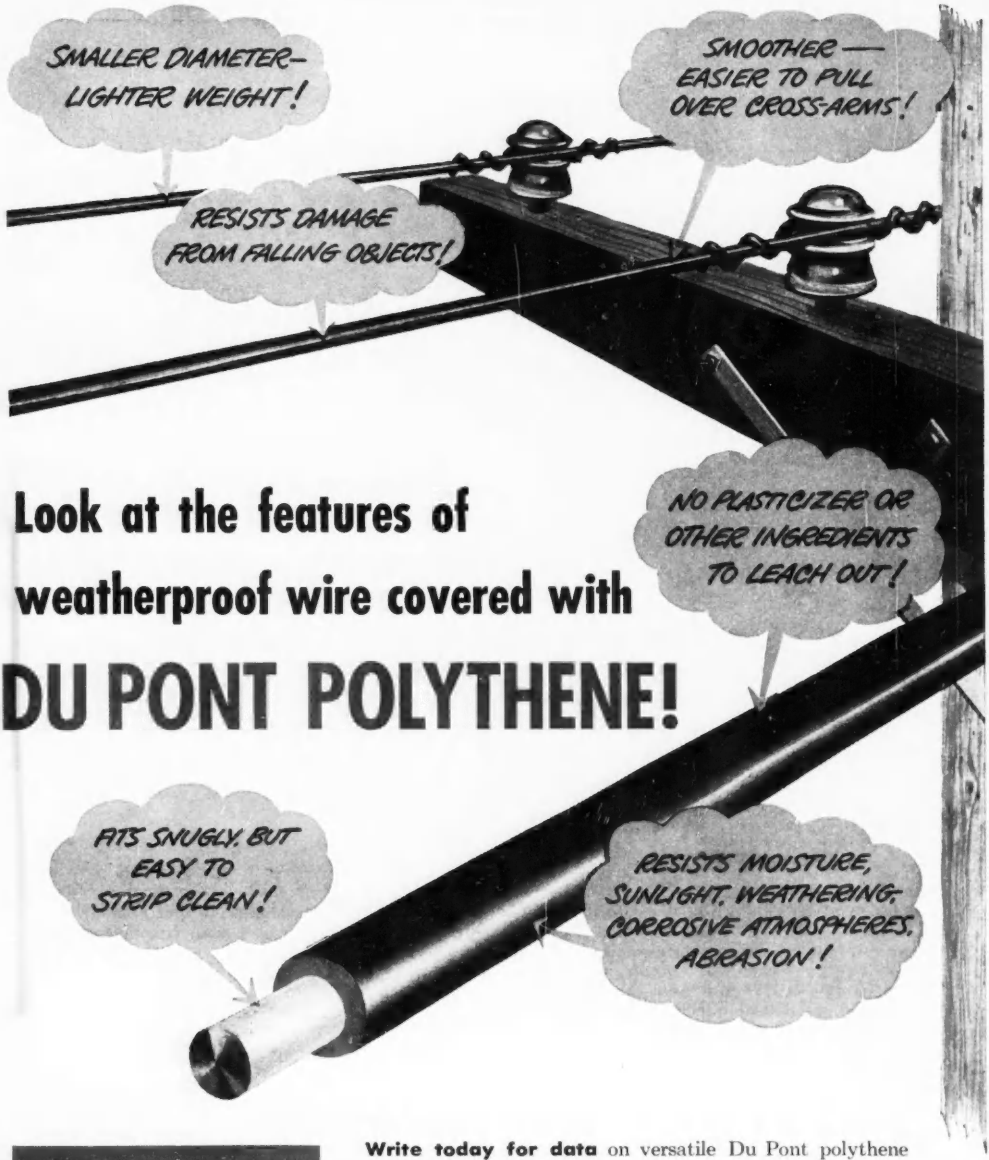
SMALLER DIAMETER— LIGHTER WEIGHT!
SMOOTHER — EASIER TO PULL OVER CROSS-ARMS!
RESISTS DAMAGE FROM FALLING OBJECTS!
NO PLASTICIZER OR OTHER INGREDIENTS TO LEACH OUT!
FITS SNUGLY, BUT EASY TO STRIP CLEAN!
RESISTS MOISTURE, SUNLIGHT, WEATHERING, CORROSIVE ATMOSPHERES, ABRASION!

Look at the features of weatherproof wire covered with

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Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Write today for data on versatile Du Pont polythene plastic! Easy to mold, extrude and fabricate . . . offers a remarkable combination of properties to the electrical industry. E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Main Sales Offices: Empire State Bldg., New York 1, N. Y.; 7 South Dearborn St., Chicago 3, Ill.; 845 East 60th St., Los Angeles 1, Calif.

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NOW a complete line of POLE STAR Transformers
from 3 KVA through 100 KVA . . .

PENNSYLVANIA TRANSFORMER
POLE STAR TRANSFORMERS TO

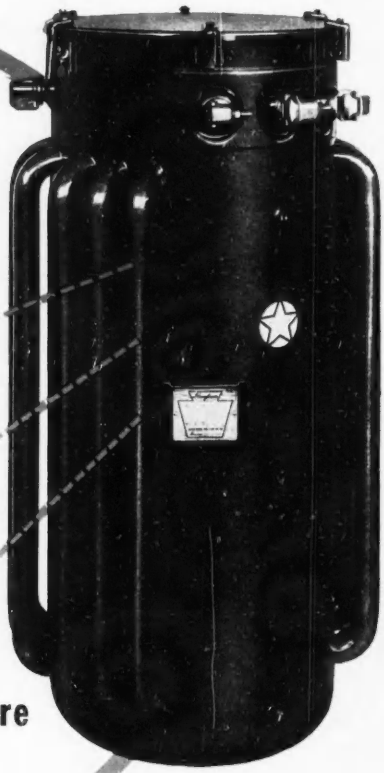
The New
100 KVA POLE STAR
TRANSFORMER

is **35%** *lighter*

requires **36½%** *less oil*

covers **35½%** *less floor area*

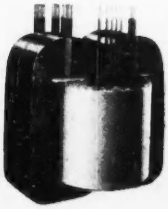
than the 100 KVA Stacked Core Transformer it replaces



PENNSYLVANIA POLE STAR TRANSFORMER

P.S. **let the POLE STAR be your guide**

Product Of Long Experience
Safe, Thrifty And Reliable



- Core and coil unit — small, compact, light in weight
- Core can be removed from coil and reassembled without special tools and without changing the electrical characteristics of the steel.

COMPANY EXTENDS ITS LINE OF SIZES 37½, 50, 75 AND 100 KVA

POLE STARS ARE BETTER! — that's the reason PENNSYLVANIA is introducing four new POLE STAR Transformers to replace four conventional type units. POLE STARS are better from the Customer's point of view, from the Operator's point of view, and from the Manufacturer's point of view. POLE STAR Transformers possess better electrical and mechanical characteristics; they are more economical to operate, less costly to store and easier to install.

The new POLE STAR Transformers are lighter in weight and smaller in dimensions than the stacked core transformers they replace. As a matter of fact, weights are down as much as 40%, cubical dimensions as much as 37%, and volume of oil as much as 50%.

COILS EASILY REPLACED IN THE FIELD

The POLE STAR wound core is designed to embody all the advantages of cold rolled steel, plus the advantages inherent in the conventional stacked core, such as the ease of removing the core and replacing the coil. The POLE STAR core can be taken apart and rebuilt without special tools and without changing the core loss or exciting current of the transformer.

LOW EXCITING CURRENT

Because laminations are individually lapped there are no gaps or butt joints in the core. The large cross section area at the lap reduces the density and prevents a concentration of flux. This lap construction assures a low exciting current.

All POLE STAR Transformers are built in accordance with A.S.A. and E.E.I. — NEMA Standards and are, therefore, of Sealed Tank Construction.

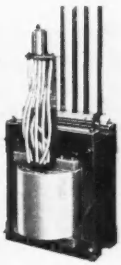
We invite you to inspect the New POLE STAR Transformers and study their merits. If you are interested in arranging such an inspection, please write us at 808 Ridge Avenue, Pittsburgh 12, Pa., You'll find the POLE STAR worth looking into.

Pennsylvania TRANSFORMER COMPANY

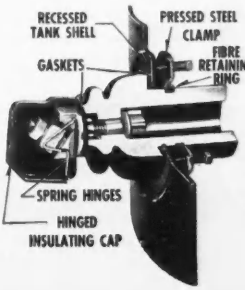
PITTSBURGH 12, PENNSYLVANIA

Write for Catalog No. 1049.

- Cover Bushings for 7200 to 14400 Volt Transformers
- Synthetic rubber gaskets
- Round tubes expanded into tank wall and welded internally

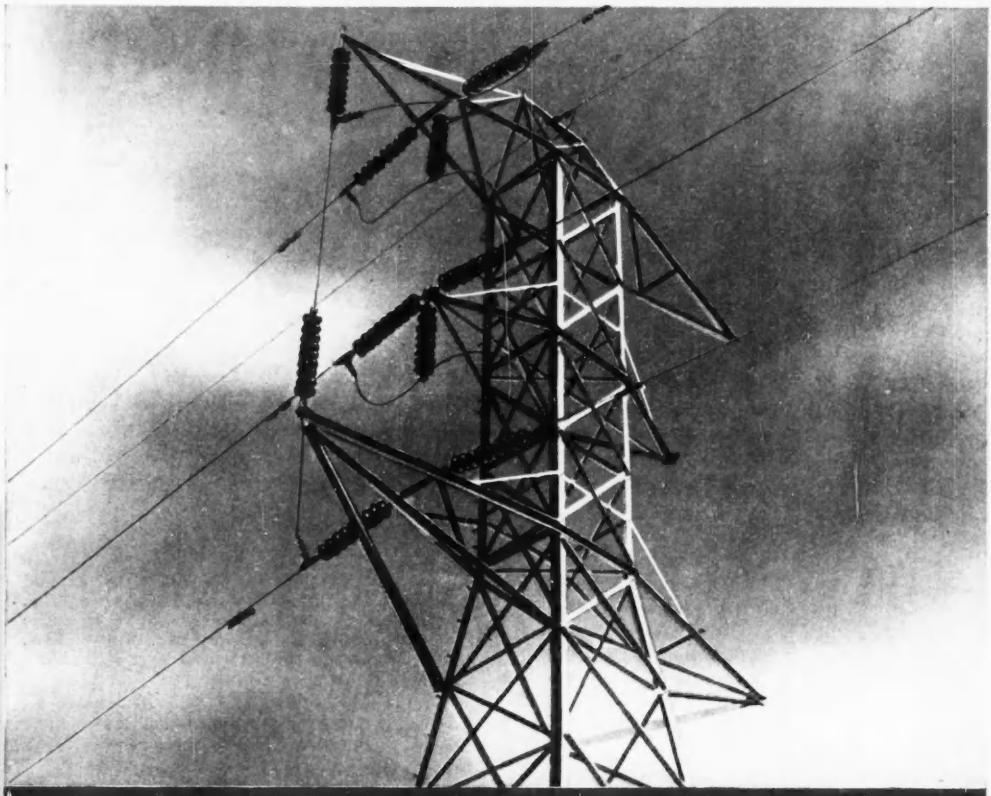


- Core frames independent of core and exert no pressure on core
- Coils firmly braced between insulating blocks
- Snap action tap changer



- No pockets on the POLE STAR
- Rugged, side-issuing High Voltage bushings for 2400 and 4800 volt transformers
- Lathe turned, pugged clay bushings

- Line connections made with standard wrench
- Insulating cap swings in and out of position
- Line leads enter terminals from downward angle



TRANSPOSITION to New Economy

Today utilities are aware that post-war urgencies are rapidly diminishing . . . and that with the return to normal demands, many operating economies are again possible. That's why more cost-conscious management men are calling in Hoosier . . . are taking advantage of the economies offered by this supplementary service. For 30 years, Hoosier engineers, trained men, and special equipment have served utilities with every type of transmission line construction and maintenance.

If you are interested in more economical operation, call Hoosier today.

HOOSIER ENGINEERING CO.

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

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"Anaconda"...always means

Keeping-Ahead-of-the-Parade

TAKE CB* CABLE WITH F-3**
ALLOY SHEATH FOR INSTANCE:

In 1939

Anaconda engineers introduced Type CB cable because ordinary paper-insulated cable wasn't good enough. Carbon-black paper removes oxidation products from the insulation, eliminates ionization discharges. These and other desirable properties increase insulation stability and assure longer cable life.

In 1944

Anaconda engineers added the resilient binder for they had found a way to reduce sheath strain during daily load cycles. Made of special carbon-black paper, it is strong yet resilient, results in lower stresses in the sheath due to cushioning effect, conducts radially and is fully adequate against magnetic forces.

In 1944,

because they know cable life often is shortened by premature sheath failure, Anaconda engineers gave this Type CB cable the amazing F-3 alloy-lead sheath. It is the best all-around alloy ever offered in the industry . . . resists slow-bending fatigue, creep (expansion), bursting, abrasion, vibration fatigue and does not age-harden . . . actually extends sheath life more than three times ordinary sheath. It has truly earned the name "indefatigable." 4940

*CB — Carbon-Black. Trade Mark Registered U. S. Patent Office
**F-3 — Arsenic-Lead alloy (U. S. Patents 2,300,758 and 2,374,755)

THIS COMBINATION permits heavier loads for longer life!

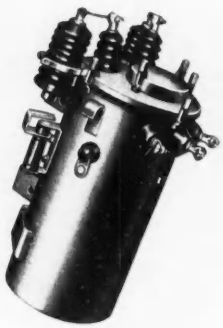
ANACONDA

ANACONDA WIRE & CABLE COMPANY

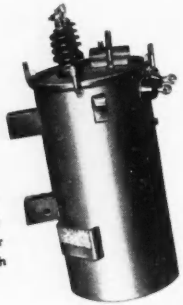
25 Broadway, New York 4, N. Y.

Uptegraff Distribution Transformers

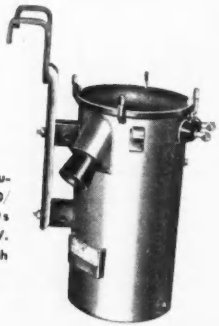
All commercial sizes, types and ratings (3 KVA to 500 KVA)



25 KVA, CSP Type, 7200/12470Y — 120/240 volts. Efficient, dependable, trouble-free.



25 KVA, Type UD, 7200/12470Y — 120/240 volt Distribution Transformer with cover mounted High Voltage Bushings.



25 KVA, Type UD, Distribution Transformer rated 2400/4160Y—120/240 volts with pocket mounted H. V. Bushings. Shown with hanger irons.

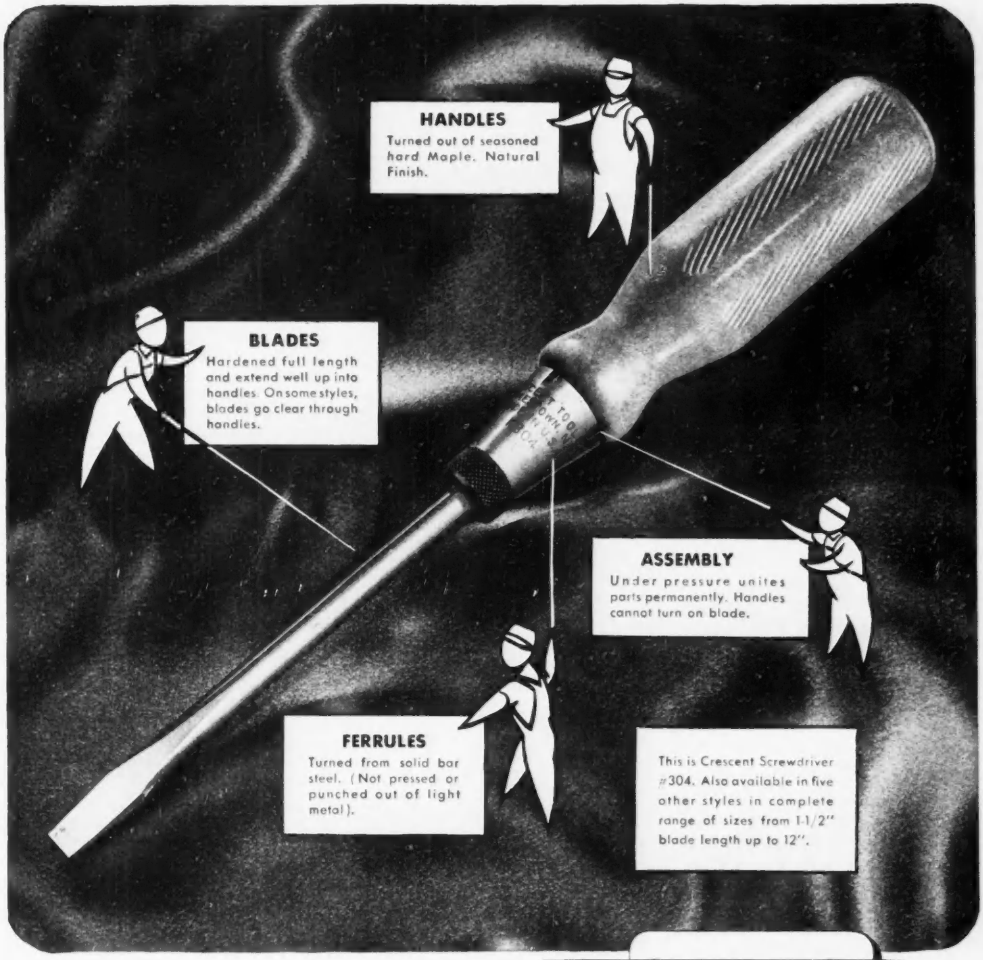
The high efficiency and dependability of Uptegraff Distribution Transformers are the result of extensive experience in the design, construction and application of all types and sizes of transformers. The three types shown here represent the best of modern engineering practice. Some of the features are: light-weight cores with preferred grain orientation for low exciting current, extra short-time overload capacity, heavy-duty construction, provision for NEMA standardized accessories, oil or askarel immersed.

WRITE
for complete details.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pa.

Makers of POWER • DISTRIBUTION • INSTRUMENT • SPECIALTY Transformers

CRAFTSMEN RECOGNIZE QUALITY *by these fine features in a* SCREWDRIVER


HANDLES
Turned out of seasoned hard Maple. Natural Finish.
BLADES
Hardened full length and extend well up into handles. On some styles, blades go clear through handles.
ASSEMBLY
Under pressure unites parts permanently. Handles cannot turn on blade.
FERRULES
Turned from solid bar steel. (Not pressed or punched out of light metal).
This is Crescent Screwdriver #304. Also available in five other styles in complete range of sizes from 1-1/2" blade length up to 12".

EVERYBODY RECOGNIZES QUALITY *by this Trade-mark*

CRESCENT TOOLS

Sign of the Artisan
Symbol of Excellence

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

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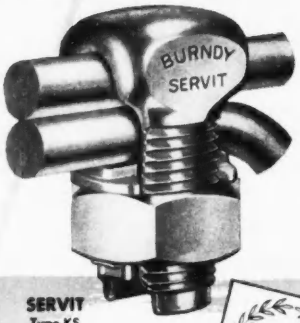
OVERHEAD

Many transmission and overhead distribution connectors are available in the comprehensive Burndy connector line. All are compactly designed, install easily and quickly, provide efficient, high strength connections. Send for catalog, or ask for engineering assistance. BURNDY Engineering Company, New York 54, N. Y. WESTERN BRANCH: Vernon 11, California. CANADA: Canadian Line Materials, Ltd., Toronto 13.



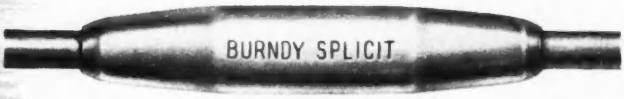
SERVIT
Type KS

25 YEARS OF SERVICE

Connect with
BURNDY

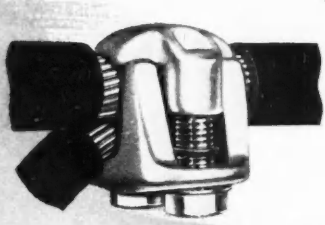
FULL TENSION HYSPLICE
Type YDS

Hysplice . . . for loop or full tension service on copper and copperweld conductors. Rapid circular indent bonds the Hysplice (beryllium copper lined) to conductor for permanent, efficient connection. For ACSR too. All rapidly installed with compact, light-weight Burndy HYPRESSES.

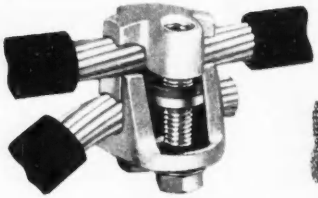


SPLICIT
Type PS

Splicit provides two grips instead of one . . . a positive initial grip which holds securely until full tension is applied and full-tension gripping jaws take over. A positive splice every time. Smaller, lighter, more compact.



OKLIP
Type KVS

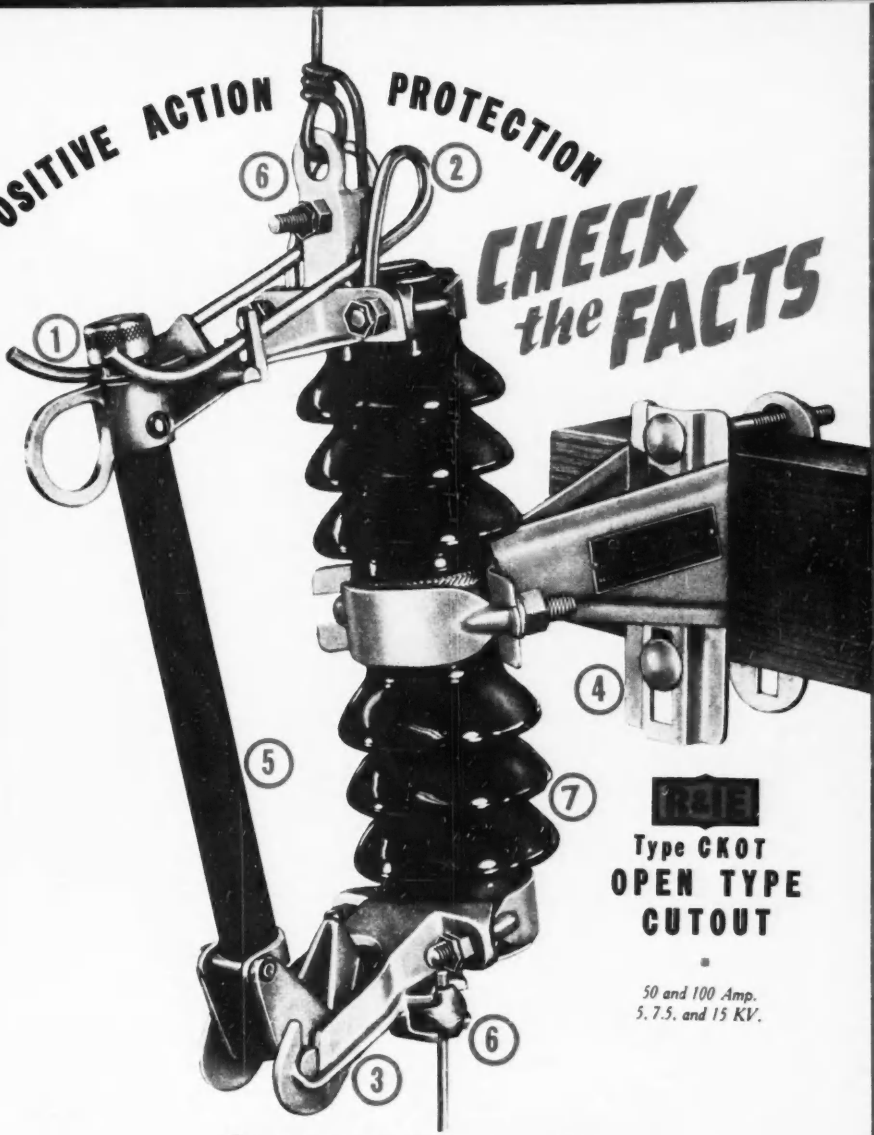


OKLIP
Type KVSU —
takes all combinations,
copper, aluminum, steel.

BUTTIN
Type KD

POSITIVE ACTION PROTECTION

CHECK the FACTS



R&IE

Type CKOT OPEN TYPE CUTOUT

50 and 100 Amp. 5, 7.5, and 15 KV.

1. CONTACTS—Hi-Pressure, self-cleaning.
2. HORN—High conductivity, uniform pressure.
3. CURRENT CARRYING PARTS—all non-ferrous. Designed to maintain alignment and assure reliability.
4. BRACKET—high strength,—clamps rigidly with two half-inch bolts. Permits range of horizontal angular positions.
5. TUBE—Extra heavy horn fibre lined bakelite expulsion tube—top contact casting one piece—accommodates any universal link. High interrupting capacity.
6. TERMINALS—Positive grip, clamps sizes from No. 8 to 4/0 stranded—large anchor eye at top for snubbing.
7. PORCELAIN—NEMA Standard B.I.L.

Tubes interchangeable with repeating cutouts. (R&IE Thermo-Rupters recommended because of their positive action.)

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

AILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA. • In Canada—Eastern Power Devices Ltd., Toronto

THE PROOF *is in the service records!*

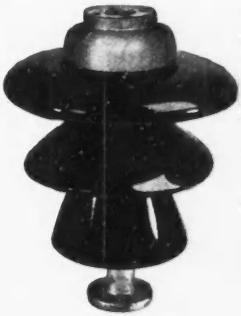
There is no better proof of the superiority of Amcreco Poles, Cross Arms and Conduit than the actual service records. It is the best indication of the long pole life and freedom from maintenance troubles for users of Amcreco. We will be pleased to show you typical service records and point out how Amcreco can reduce your cost per pole per year. Write today.

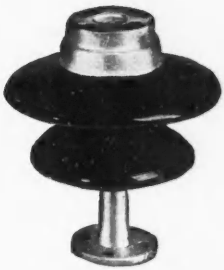
Amcreco
Lowry Process
Creosoted Products

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY INCORPORATED
AMCREO LOWRY PROCESS CREOSOTED WOOD
GEORGIA CREOSOTING COMPANY INCORPORATED
LOUISVILLE, KENTUCKY

POLES • CROSS ARMS • CONDUIT

J-D



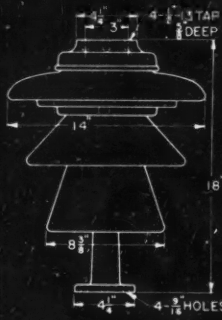


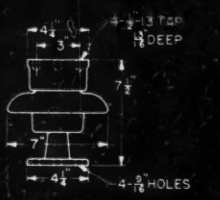
Write for Bulletin No. 700

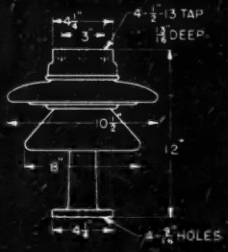
★ ★ ★ ★ ★

SWITCH and BUS *Insulators*

Cap and Pin Type







NEMA
Standard Strength
B. I. L.

JEFFERY-DEWITT INSULATOR CORP.

Kenova, West Virginia, U.S.A.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

PROOF - *not Guesswork*

Makes FWD America's Foremost Heavy-Duty Truck

Here's actual operating proof by one of the nation's leading utilities! Plowing through deep sand to location! That's an everyday job for this heavily equipped FWD line construction unit. Work such as this demands going-power only four driving wheels can give you. It demands on-the-job dependability you get with FWDs. What's more, youknow before you buy, because FWDs are scientifically tested on FWD's proving ground to climb a 6% grade through blow sand 3 feet deep! *No wonder over 200 of the nation's top utilities use FWDs — with individual fleets up to 192 units!*

WHAT FWDs DO ON THE PROVING GROUND
1 Highball over hilly curved roads!
2 Slog thru mud — up to the bumper!
3 Speed over 100-ft. unbanked circle!
4 Twist over ditches —18 inches deep!
5 Drive up 6% grade thru 3-ft. of sand!
6 Climb 70% grade from dead stop!
7 Climb 8-in. beam from standstill!
8 Drill pole holes to prove equipment!
9 Speed safely over level highways!

This is FWD's proving ground. This is your assurance that the FWD you select has the stamina to insure long life without expensive mechanical breakdowns.

An FWD plows through 3 feet of sand at the proving ground. For all the facts about FWD Built-to-Gode units, see your Graybar distributor — or write FWD.

An Invitation To Truck Buyers

We invite you to watch FWDs pass a series of rigid performance tests. Ask your FWD distributor to arrange your visit to our plant. Or — if you can't get away, ask him to show you the movie, *The FWD Story*. In either case, you will see for yourself how FWD trucks can help solve your heavy-duty trucking problems.

Martin A. Otte
President
The Four Wheel Drive Auto Company

THE FOUR WHEEL DRIVE AUTO COMPANY
Clintonville, Wis. • *Canadian Factory:* Kitchener, Ontario
FOUR AND SIX WHEEL DRIVE TRUCKS

America's Foremost Heavy-Duty Truck

Your Central Conduit Distributor is a dependable source of supply

CENTRAL
~~SPANG~~
CONDUIT

The complete stocks maintained by your Central Conduit Distributor make it easy for you to get electrical supplies quickly.

Electrical Raceways are a good example of his fine selection of material. Spang's rigid steel conduit comes in three finishes: *Cenlaco* has a hot dipped galvanized and lacquered finish inside and out; *Central White* is electro galvanized outside and black enameled inside; *Central Black* has a permanent, baked on black enamel finish, inside and out. All of these are approved by the Underwriters Laboratories Inc., for use in hazardous locations and occupancies.

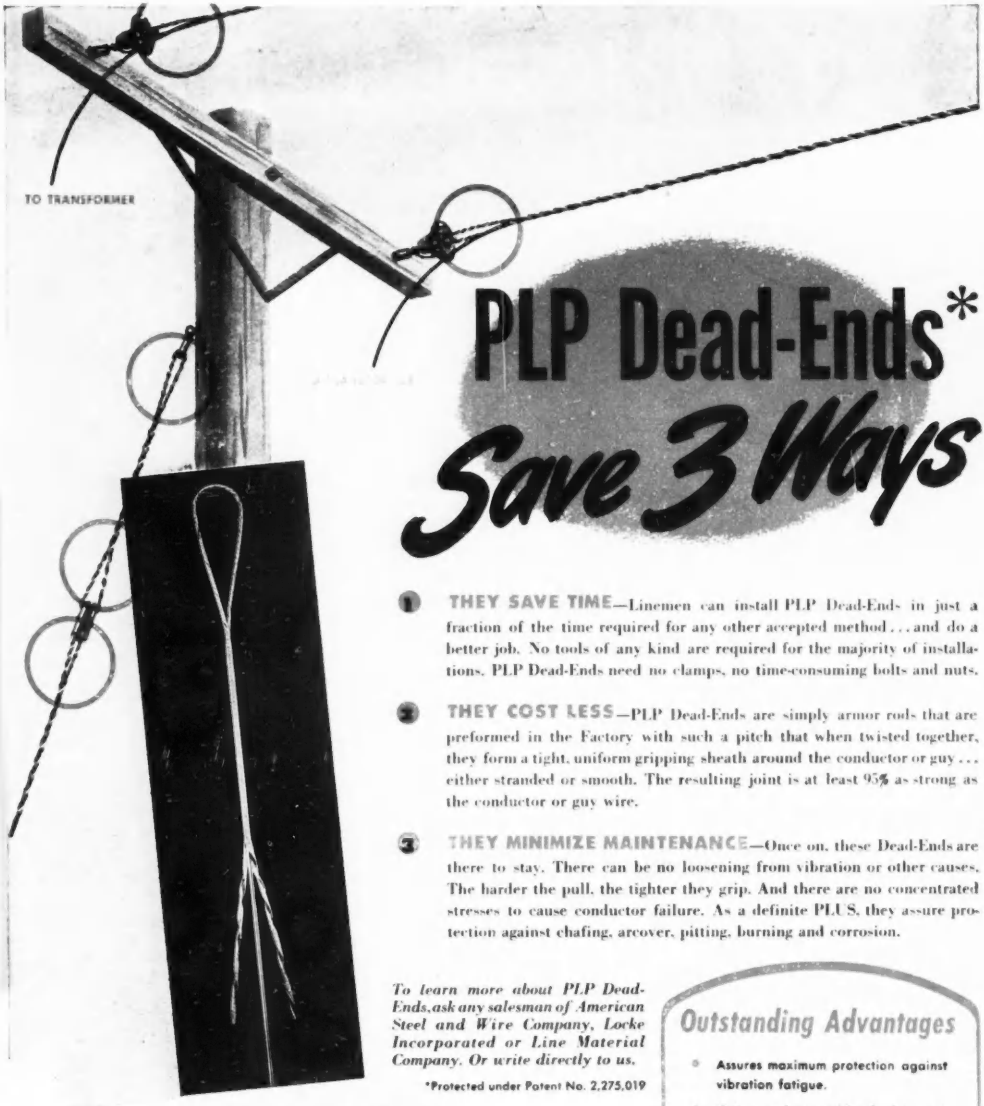
For good service and quality materials contact your Central Conduit Distributor—you'll find he's a dependable source of supply.

SPANG-CHALFANT
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.



PLP Dead-Ends* Save 3 Ways

1. **THEY SAVE TIME**—Linemen can install PLP Dead-Ends in just a fraction of the time required for any other accepted method . . . and do a better job. No tools of any kind are required for the majority of installations. PLP Dead-Ends need no clamps, no time-consuming bolts and nuts.

2. **THEY COST LESS**—PLP Dead-Ends are simply armor rods that are preformed in the Factory with such a pitch that when twisted together, they form a tight, uniform gripping sheath around the conductor or guy . . . either stranded or smooth. The resulting joint is at least 95% as strong as the conductor or guy wire.

3. **THEY MINIMIZE MAINTENANCE**—Once on, these Dead-Ends are there to stay. There can be no loosening from vibration or other causes. The harder the pull, the tighter they grip. And there are no concentrated stresses to cause conductor failure. As a definite PLUS, they assure protection against chafing, arcover, pitting, burning and corrosion.

To learn more about PLP Dead-Ends, ask any salesman of American Steel and Wire Company, Locke Incorporated or Line Material Company. Or write directly to us.

*Protected under Patent No. 2,275,019

EASY TO APPLY

Simply slip one end of the PLP Dead-End through the strain insulator, insulator eye or clevis; position on the conductor or guy wire; and simply twist into place by a hand motion like "wringing a cloth". No tools are needed, no clamps for holding.

Outstanding Advantages

- Assures maximum protection against vibration fatigue.
- Grips conductor with absolute uniformity . . . no concentrated stresses.
- Unexcelled conductivity provides reserve capacity for short circuits and overloads . . . particularly suitable for hot-line clamps.
- Neat, inconspicuous appearance.

PLP COMPANY

PREFORMED LINE PRODUCTS COMPANY
1051 POWER AVENUE • CLEVELAND 14, OHIO

HERE'S A *Wow*

OF A WAY TO PUT

MORE STEAM BEHIND YOUR

FALL BULB PROMOTION

If you are planning a Fall light bulb promotion, you'll want to consider the possibility of a tie-in with the new Westinghouse consumer contest.

It's the "WHO IS MISS FAMOUS" contest. Millions of Americans will be seeing ads like the little one up there (but in full size, of course) during the period October 15 to December 4. By tieing in, you'll gain the impact and momentum of this major activity.

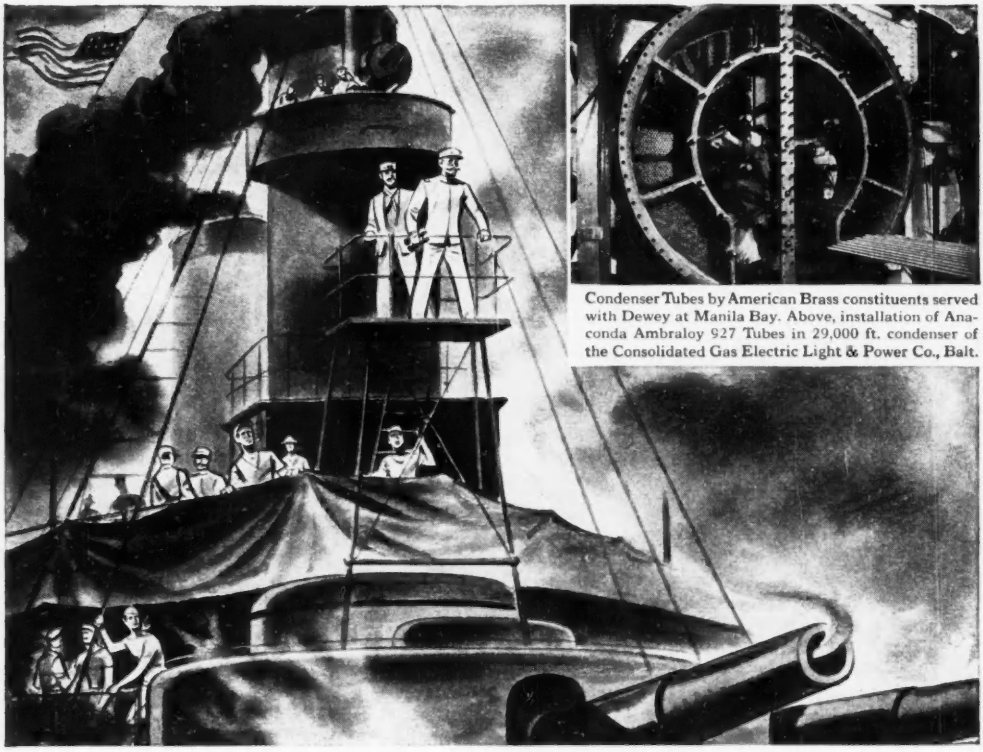
And think of the sales you'll gain! People will literally be looking for Westinghouse bulbs. That's exactly what happened last Spring when Westinghouse sponsored the first consumer contest ever staged in the light bulb business. YES, here's a sure way to more sales and more load.

Cash in on this promotion! Contact your local Westinghouse District Office NOW (see below), or write to the Lamp Div. Westinghouse Electric Corp., Bloomfield, N. J.

WESTINGHOUSE LAMP DISTRICT OFFICES:

Boston	10 High Street
Chamblee, Ga.	2260 Peachtree Industrial Blvd.
Chicago	20 N. Wacker Drive
New York	40 Wall Street
Philadelphia	3001 Walnut Street
Pittsburgh	419 Wood Street
San Francisco	410 Bush Street
St. Louis	411 N. 7th Street

YOU CAN BE SURE...IF IT'S Westinghouse



Condenser Tubes by American Brass constituents served with Dewey at Manila Bay. Above, installation of Anaconda Ambraloy 927 Tubes in 29,000 ft. condenser of the Consolidated Gas Electric Light & Power Co., Balt.

The U.S. History of Condenser Tubes is a Story of AMERICAN BRASS

FOR MORE THAN TWENTY YEARS before the steam turbine brought surface condensers into the electrical generating scene, founding members of The American Brass Company had been furnishing seamless, cold-drawn copper and copper alloy condenser tubes to American naval and merchant ships and to the British Admiralty.

Manufacture of these tubes was first begun by the cast shell method in 1870. Since then, members of The American Brass family have taken the lead in condenser tube development.

In the 90's Benedict Metal provided the first cupro-nickel tubes.

In 1896—importation of the Mannesmann Process for hot rolling tubes.

In the late 90's—the first Admiralty tubes.

In 1909—the cup-drawn process for tubes.

In 1912—the finishing light anneal to eliminate the tendency to lengthwise splitting known as "season cracking."

In 1930—the first use of extrusion presses for condenser tube stock; which, after cold rolling and drawing still produces the most physically perfect tubes.

New 40-page booklet on Condenser Tubes and Tube Sheets, currently produced in eight standard and several special alloys, now available. Write for Publication B-2.

ANACONDA

Anaconda

CONDENSER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

A Compact New Starter for Fractional Hp Motors

. . . that provides

Reliable

OVERLOAD PROTECTION

Open view of enclosure for surface mounting

Closed view of enclosure for surface mounting

Bulletin 600 Switch with waterproof enclosure

Bulletin 600 Switch fits any standard switch box

Here is a small, manually operated starter that will satisfy the latest ruling of the National Electrical Code . . . which requires overload protection for a great many fractional horsepower motor applications. The Bulletin 600 Starting Switch is built in the single- and double-pole construction, and is rated one horsepower and less. Its dependable thermal breaker trips the switch under a sustained overload, protecting the motor against burn-out. When the overload is cleared, the breaker is easily reset with the switch lever. However, the switch cannot be held closed so long as the overload condition remains.

The Bulletin 600 Starter is available in enclosures to meet every service requirement. Send for complete data. Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin.

A-B Quality

ALLEN-BRADLEY

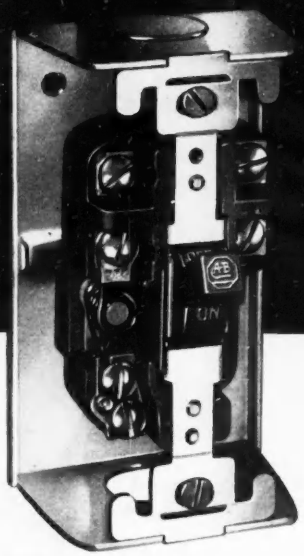
BULLETIN 600 STARTING SWITCHES

QUALITY

SEE OTHER SIDE

SAVE 30% to 40% of INSTALLATION TIME

on Starters for Small Motors (1 hp or less)



BULLETIN 600

Manual Starting Switches with Overload Protection

•

No Need to Remove Starter from Enclosure

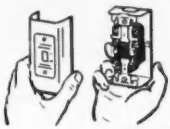
Installation of the Bulletin 600 Starting Switch is so simple that contractors have saved as much as ten minutes in installation time. In addition, they have found the switch exceptionally reliable.

•

GENEROUS WIRING SPACE
ATTRACTIVE APPEARANCE
SIMPLE DESIGN

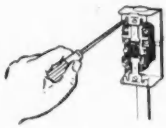
STEP 1—REMOVE COVER

Simply remove two screws on the front of the Bulletin 600 Starting Switch and the metal cover slips off, exposing the front and two sides of the switch.



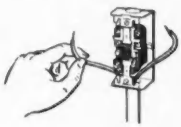
STEP 2—MOUNT UNIT

Mount the switch on the wall with two screws. Conduit openings on top, bottom, and back permit easy connection. No need to remove the starter from the box.



STEP 3—PULL IN WIRES AND CONNECT

Because the compact mechanism allows ample space, wires can be pulled into the box and connected to the terminals without removing the switch from the enclosure.



STEP 4—PUT COVER BACK ON

Finally, with the job completed, the cover is slipped back on, and two screws hold it firmly in place. The entire operation is simple and easy. It saves time and money.

A-B Quality

ALLEN-BRADLEY

MANUAL STARTING SWITCHES FOR SMALL MOTORS

QUALITY

"KNOWLEDGE IS **POWER**"

when...ENGINEERING and

CONSTRUCTION EXPERIENCE *combine*

Another Bechtel-built power station is on the line—a mountain hydro plant producing 40,000 horsepower of new electrical energy.

Another result of knowledge in the field of power engineering and construction

... promptly made available for accurate and economical interpretation of client needs.

BECHTEL CORPORATION

SAN FRANCISCO • LOS ANGELES • NEW YORK

Under single responsibility:

ECONOMIC STUDIES • PROCESS DESIGN • ENGINEERING • PURCHASING • CONSTRUCTION

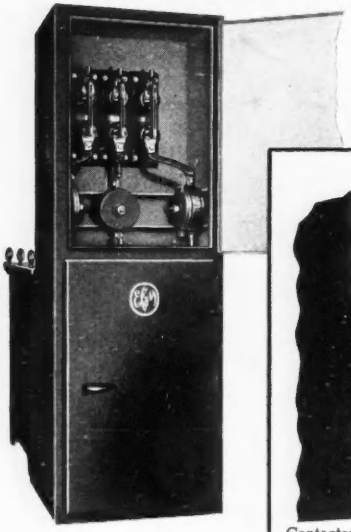
2300-4600 VOLT MOTOR SHORT CIRCUIT PROTECTION SIMPLIFIED

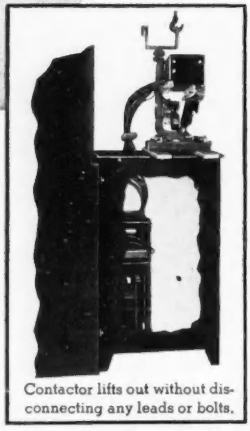
UNLIMITED PROTECTION AT ONE COST

EC&M VALIMITOR* STARTERS

1. Eliminate calculation of available KVA.
2. Prevent future revisions as KVA grows.
3. Reduce effect of "short" clear back to the power source.
4. Give *permanent* protection—no future changes, nothing to replace after a fault.
5. Permit standardized starters suited for circuit of *any* power capability.

*Trade Mark (Volt-Ampere-Limitor).





Contactor lifts out without disconnecting any leads or bolts.

Short circuit protection that is constant and does not change with the times is an important feature of EC&M VALIMITOR Motor Starter for 2300-4600 volt motor drives.

Instead of a starter built to suit existing KVA requirements, EC&M VALIMITOR Starters may be connected to a bus of any capacity. These new starters are designed to limit fault currents from a bus of *infinite* capacity to 25,000 KVA (steady state current). The heavy duty contactor of 50,000 KVA interrupting capacity clears such faults quickly.

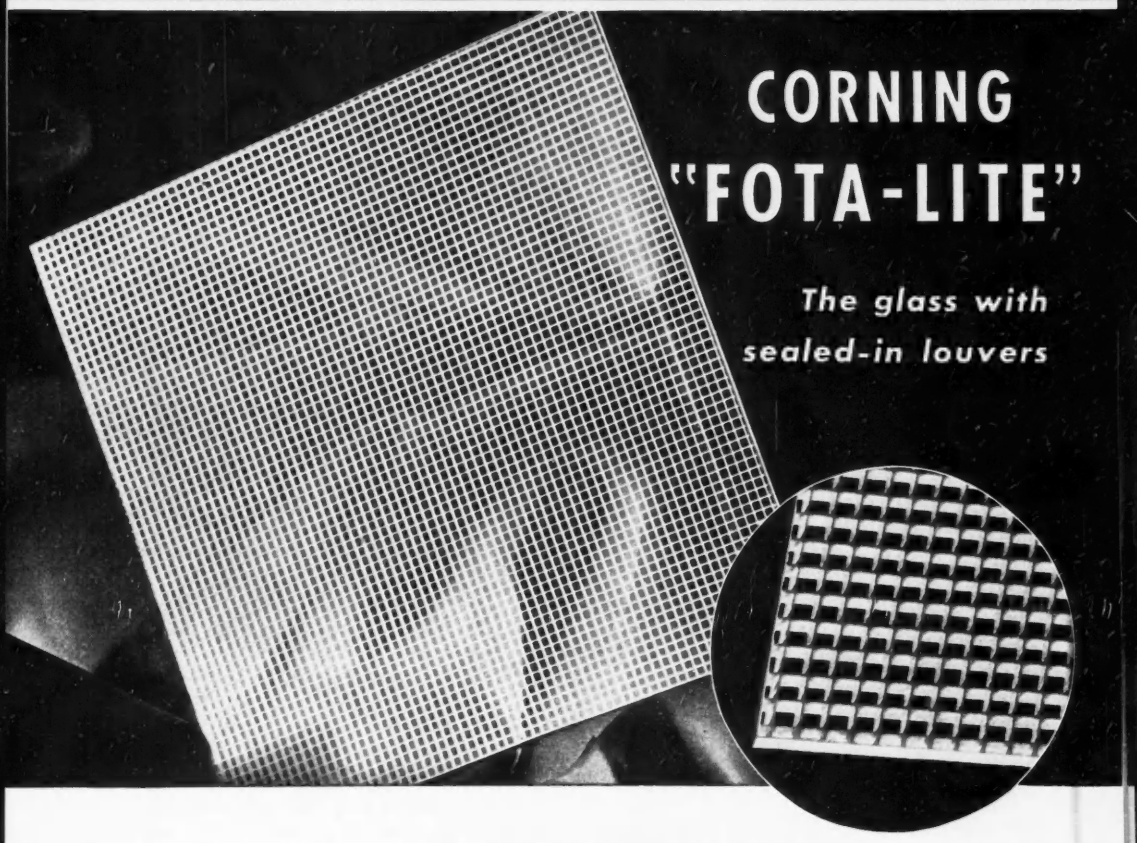
EC&M VALIMITOR Starters also improve starting conditions. Lower inrush current and a smoother start may save the cost of the more expensive reduced voltage starter. When the motor is up to speed, these starters function like any standard full voltage starter.

Send only name-plate data of your motors for complete information on EC&M VALIMITOR Starters.

MAXIMUM RATINGS		
Squirrel-cage, Synchronous or Wound-Rotor Motors		
2300 Volts		4600 Volts
600 HP	60 Cycles	600 HP
300 HP	25 Cycles	250 HP

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

Something *Really* NEW in lightingware



CORNING "FOTA-LITE"

The glass with sealed-in louvers

Now you can get "egg crate" fluorescent lighting effect *without the egg crate!* Corning "Fota-Lite" is a new glass in which vertical louvers are photographically transferred to the full thickness of the glass.

EASY TO CLEAN. "Fota-Lite" presents a smooth surface which you can wipe clean quickly—something that is impossible with ordinary exposed louvers. Since you can completely enclose the fixture, both tubes and reflectors also remain clean. Thus, you never lose original efficiency through the accumulation of grime and dust.

HIGH EFFICIENCY. Brightness at high angles is low. Yet, the transparent area is comparable to the finest crystal. Light directed vertically is almost unrestricted but a slight surface diffusion obscures tubes and reflectors. The 45° cut off is obtained within the thickness of the glass (1/8") instead of bulky and costly louvering materials.

NO COLOR CHANGE. The opalescent louvers are non-selective in color transmission and as they are sealed within the glass surface, discoloration is impossible. This is important in maintaining original color values.

CORNING means research in GLASS

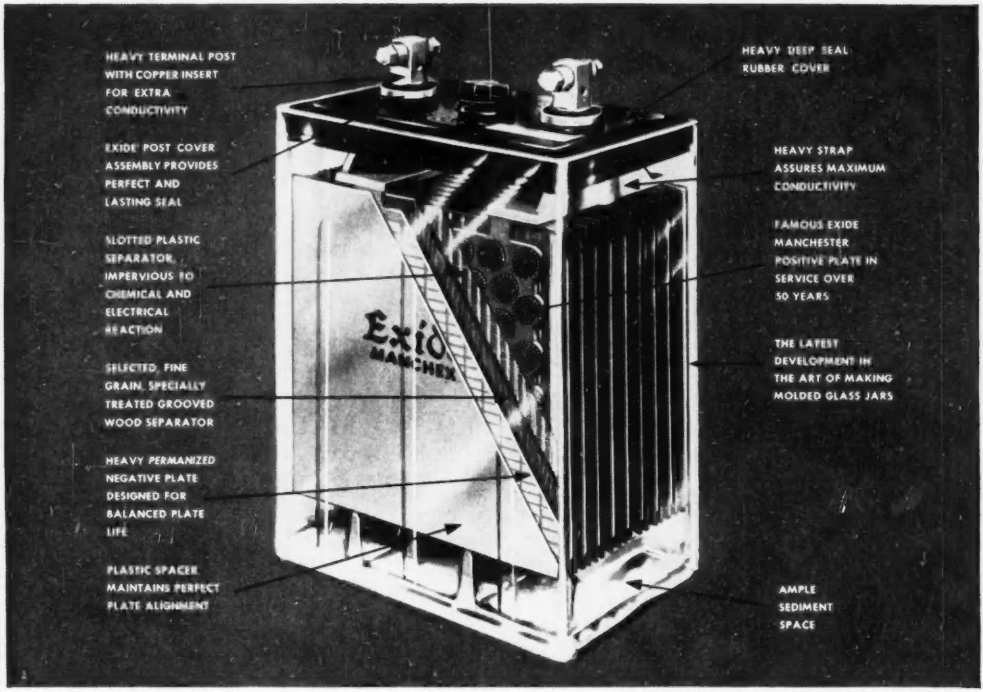
PYREX T.M. REG. U.S. PAT. OFF.

LIGHTINGWARE

CORNING GLASS WORKS, CORNING, NEW YORK

NEW-EXIDE-MANCHEX battery

for dependable CENTRAL STATION SERVICE


HEAVY TERMINAL POST WITH COPPER INSERT FOR EXTRA CONDUCTIVITY
EXIDE POST COVER ASSEMBLY PROVIDES PERFECT AND LASTING SEAL
SLOTTED PLASTIC SEPARATOR, IMPERVIOUS TO CHEMICAL AND ELECTRICAL REACTION
SELECTED, FINE GRAIN, SPECIALLY TREATED GROOVED WOOD SEPARATOR
HEAVY PERMANIZED NEGATIVE PLATE DESIGNED FOR BALANCED PLATE LIFE
PLASTIC SPACER MAINTAINS PERFECT PLATE ALIGNMENT
HEAVY DEEP SEAL RUBBER COVER
HEAVY STRAP ASSURES MAXIMUM CONDUCTIVITY
FAMOUS EXIDE MANCHESTER POSITIVE PLATE IN SERVICE OVER 50 YEARS
THE LATEST DEVELOPMENT IN THE ART OF MAKING MOLDED GLASS JARS
AMPLE SEDIMENT SPACE
Exide
MANCHEX

"Exide" and "Permanized" *Reg. Trade-Marks U. S. Pat. Off.*

One of its many exclusive features is the famous MANCHESTER POSITIVE PLATES with their unique lead button construction. The buttons—rolled strips of corrugated soft lead—are pressed into holes of the lead-antimony grid. Forming action expands the buttons and locks them securely in place. Only a comparatively small portion of the total lead is formed initially into active material . . . the balance is available for gradual conversion in service.

THE PERMANIZED NEGATIVE PLATES are constructed of a lead-antimony grid, or framework, with a series of vertical ribs connected by short horizontal bars. Bars are flush with plate surface . . . extend only part way through the plate . . . are staggered on opposite sides. The active material . . . sponge lead . . . is formed of vertical strips or ribbons that extend from top to bottom of the plate between the vertical ribs and is locked in place by the horizontal bars.

The new EXIDE-MANCHEX BATTERY has a high, 1 minute rating. It will provide up to 100% more capacity in the same given space.

LONG LIFE...LOW MAINTENANCE COST...IMPROVED ELECTRICAL CHARACTERISTICS...INCREASED POWER (watt) OUTPUT PER UNIT OF SPACE...LESS WEIGHT PER AMPERE HOUR OUTPUT...ATTRACTIVE INSTALLATION

Exide
BATTERIES

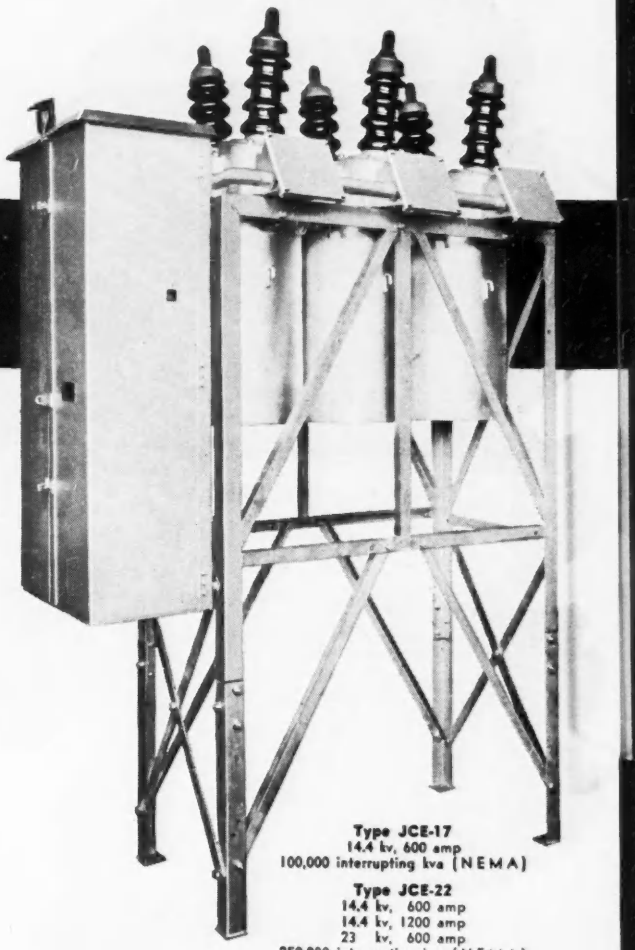
1888 — Dependable Batteries for 61 Years — 1949

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Here's the Stored-Energy Mechanism in a 14.4 kv Oil Circuit Breaker

Outdoor Type JCE-17
14.4 kv, 600 amp
100,000 interrupting kva

A Protective Unit with High-Speed, 3-Reclosures, completely tested and assembled . . . ready to operate



Low Operating Current—The Motor-Compressed-Spring Mechanism uses only a **small** motor to compress the closing spring. May be a-c or d-c.

Simple Tripping Schemes — Though d-c potential trip provides the utmost in accuracy and reliability, many conditions permit use of a-c series trip with or without overcurrent relays. If a-c is used for the spring-compressing motor, the ultimate in simplicity and low cost is attained.

Rapid Arc Extinguishment — The Pacific Electric Mfg. Corporation exclusive Expulsion Chamber extinguishes the arc with a minimum of oil carbonization or effect on contacts.

Get All Facts . .

Type JCE-17
14.4 kv, 600 amp
100,000 interrupting kva (NEMA)

Type JCE-22
14.4 kv, 600 amp
14.4 kv, 1200 amp
23 kv, 600 amp
250,000 interrupting kva (NEMA)

—with Motor-Compressed-Spring Operating Mechanism

Conform to AIEE and NEMA Adopted Standards

Call

PACIFIC ELECTRIC MFG. CORPORATION

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA • P. O. BOX 419, GARY, INDIANA

C. H. CUTTER, 912 Securities Bldg., Seattle 1, Wash.
PIERCE G. FREDERICKS, 90 West St., New York 6, N. Y.
J. E. REDMOND SUPPLY CO., 625 W. Madison St., Phoenix, Ariz.
ORMONDE SMITH, JR., 3842 Palm Ave., Houston 4, Texas
MARRS & WENDEGATZ, 526 Dwight Bldg., Kansas City 6, Mo.
L. CLAIR MITCHELL CO., 306 Commonwealth Annex, Pittsburgh 22, Pa.
F. W. GORMAN ELECTRICAL EQUIP. CO., P. O. Box 223, El Paso, Texas
G. B. KIRKWOOD, 14547 Madison Ave., Cleveland 7, Ohio
ARKANSAS ELECTRIC CO., 417 S. Hill St., Los Angeles 13, Calif.
WILLIAMSON & WILMER INC., 316 Louisiana St., Little Rock, Ark.
LEONARD M. SLUSSER, 617 Mutual Bldg., Richmond 19, Va.
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Everything IN CARBON *but Diamonds!*

PLUS GRAPHITE, MOLDED METALS SINTERED ALNICO II

HUNDREDS of STANDARD ITEMS . . . *thousands of "Specials"*

Write for details on any type

Anodes • Battery Carbons
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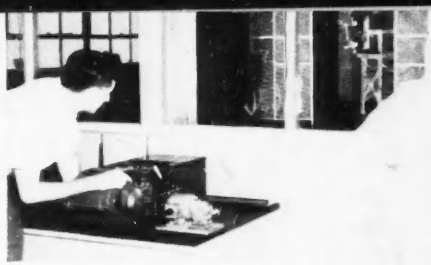
. . a dependable source of supply

The unique electrical, mechanical, physical and chemical properties of Stackpole carbon, graphite and carbon-graphite products solve countless problems of friction, temperature, arcing, corrosion, shaft sealing, voltage regulating and others. So broad is the line of standard Stackpole products, so extensive the facilities for "specials" that it is practical to list only a few of them here. Let Stackpole engineers recommend and quote on your next requirements.

STACKPOLE

STACKPOLE CARBON CO., ST MARYS, PA.



Can the cutout take it? Research Engineer and oscillograph watch to see what happens when a 6000 amp 15,000 volt fault current hits. At right: it happens! The fuse blows; the cutout is undamaged.

look what happens in L-M's new "KNOW-HOUSE"

A siren shrieks. L-M Research Engineer Blaine Schultz opens the oscillograph shutter. "BANG!" 6000 amps just blew a fuse in L-M's HXO cutout!

Another test has been recorded in L-M's "Know-House," the big new short circuit testing laboratory in South Milwaukee.

It takes a lot of equipment to make such tests possible. For instance, there is the world's largest high speed short circuit test generator. It provides over 500,000 kva—enough to light a city of half a million momentarily! Over 75,000 amps symmetrical at 4330 volts; up to 15,000 volts 3-phase, 69,000 single-phase.

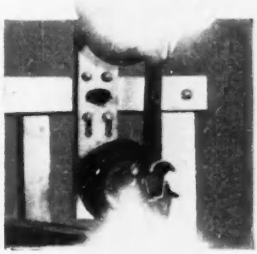
That big generator sits solidly on a million pounds of concrete. Its 14-ton rotor, driven at 3600 RPM, would coast for half an hour except for dynamic braking which brings it to a smooth stop in four minutes.

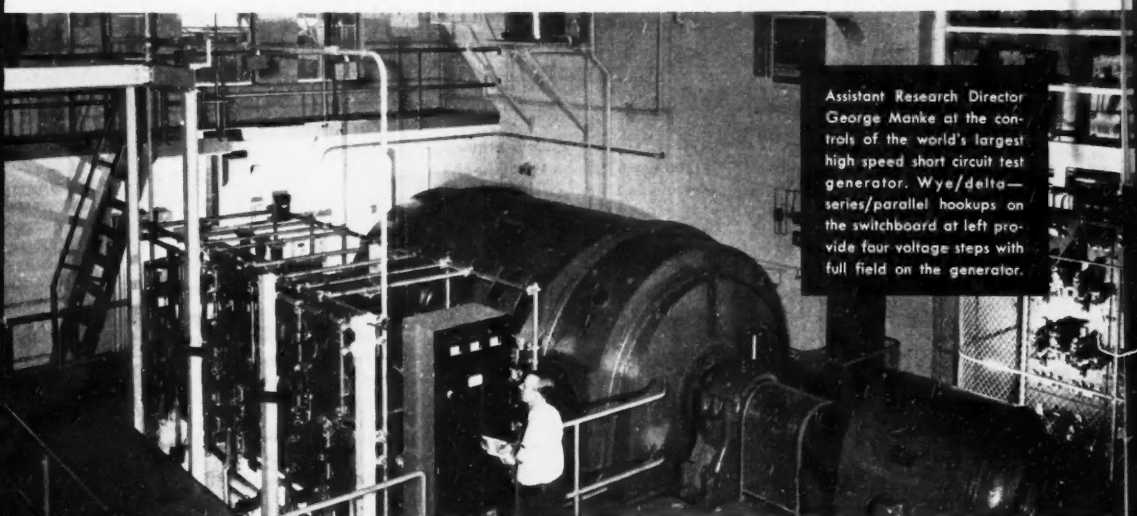
There's a variety of automatic and manual controls. A synchronous switch closes the circuit at any desired point of the 60-cycle wave. A 1,500,000 kva air blast breaker provides back-up protection.

In the control room is an auditorium which permits observers to see the tests and watch the operation of the extensive control and recording equipment. Test cells include one with 12-inch concrete walls and bullet-proof windows for explosive tests.

Much of the equipment is underground, including the oil circulating system, ducts providing 45,000 cfm of filtered air, and the tremendous generator bed.

L-M is one of only four companies in the country with such a laboratory. This means that in addition to its other extensive research laboratories and staff, L-M provides more facilities to assure L-M customers of conservatively rated, *completely tested and coordinated distribution equipment*, more facilities to meet the demand for equipment able to handle the heavier loads of today—and tomorrow.



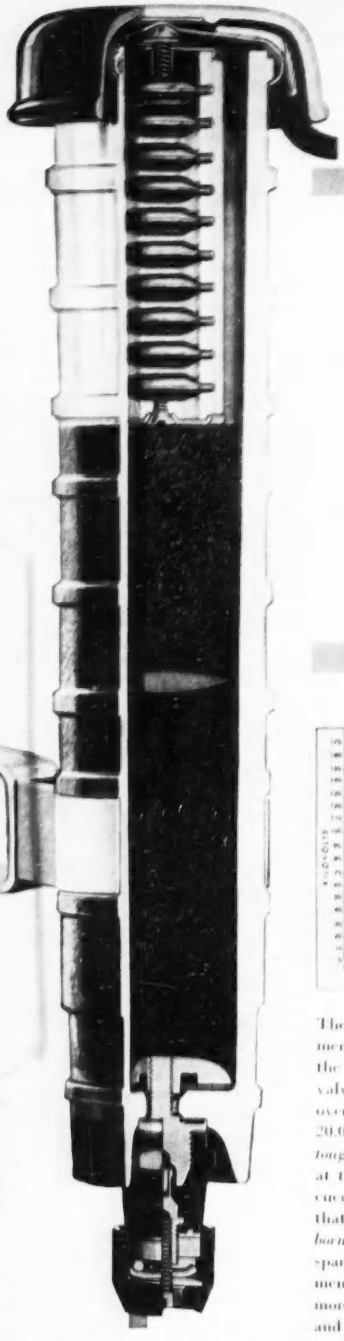


Assistant Research Director George Manke at the controls of the world's largest high speed short circuit test generator. Wye/delta—series/parallel hookups on the switchboard at left provide four voltage steps with full field on the generator.

LM

LINE MATERIAL... Research

Completely *Tested* and Coordinated Distribution Equipment



"The Isolator" L-M's patented extra protection that makes it impossible to ground feeders, no matter *what* happens to the arrester. It's standard equipment on the type E.

goldfish bowl— for lightning!

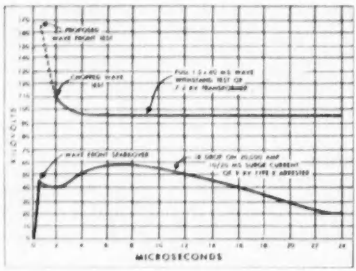
that's our L-M

HEAVY DUTY VALVE TYPE ARRESTERS

We put these L-M heavy duty valve type arresters out in glass*, right in front of everybody. So these arresters get *no* privacy. They've *got* to be good—and they are!

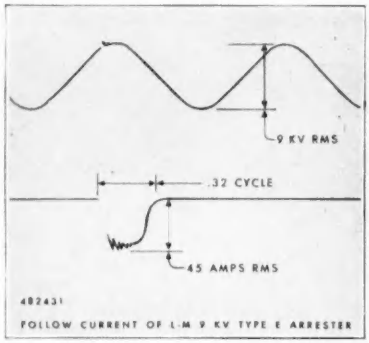
*tough Pyrex ® that won't break, shatter, or crack—don't worry about that!

PROTECTION? PLENTY!



The curves show NEMA standards requirements for transformer impulse strength, and the sparkover of the 9 kv L-M heavy duty valve "type E" arresters. Note the low sparkover on steep front waves, the IR Drop on a 20,000 amp 10/20 MS surge current. *Plenty tough*, these arresters. They just bare their teeth at the steep front surges, and stay cool as a cucumber through the hot, long tailed surges that would just "fry" a weak arrester. *Stubborn, too.* They just *won't* change their low sparkover. The "Gramulon" characteristic element doesn't change; the gap doesn't burn off; moisture doesn't get in through the double top and bottom seals. (If it ever *should*, you could see it in a glance through the "goldfish bowl.") They just go on for years and years, and we're proud of them!

Follow Current? Doesn't amount to shucks in this "type E" arrester, as you can see. Never lasts more than half a cycle, if that long! You can go right ahead and coordinate your fuses—this arrester won't even give them a warm moment.



FOLLOW CURRENT OF L-M 9 KV TYPE E ARRESTER

Has ample *discharge capacity*, too, for anything that comes along. About the only thing that can bother it is a *direct stroke*—which would probably really fix it up so we'd have to sell you a new arrester. Sizes 3, 6, 9, 12, and 15 kv.

What every buyer should know about valve type lightning arresters—all in this factual data book. *Get a copy from the L-M Field Engineer or Line Material Co., Milwaukee 1 Wisconsin.*

LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for All Distribution Requirements

KYLE RECLOSERS

Kyle reclosers offer complete protection for lines, and safety for linemen. They are the original, and still the best, automatic protection for both single and three-phase lines. They offer flexibility to meet all conditions, and precise coordination with fuses, sectionalizers, other reclosers, and station breakers. They avoid lockouts and outages, cut maintenance, and protect your equipment and service.

Outstanding Kyle Recloser Features

Three reclosures before locking out; choice of four opening sequences . . . Coils and sequences easily changed in the field . . . Trip-free operating handle. Tank and cover are dead; bushing terminals are the only live parts . . . Positive dependable operation—no motors or clockwork . . . Large cast aluminum cover; sleet hood protects operating handle and counter . . . Ratings 5 to 50 amps.; 2400 to 15,000 volts; minimum tripping current 10 to 100 amps.; interrupting capacity 150 to 1200 amps.

. . . ON SINGLE-PHASE . . . AND THREE-PHASE LINES

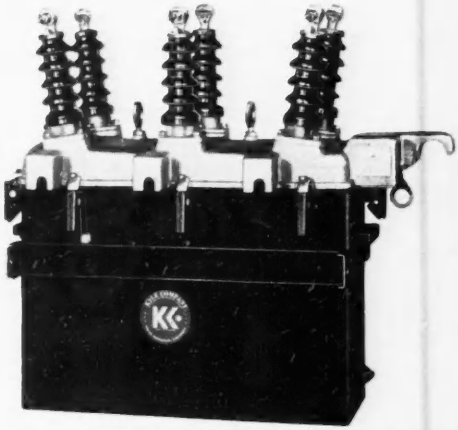
KYLE
TYPE H
Single-phase recloser

Protects feeders and branch lines on both single- and three-phase systems by coordinating with fuse links, sectionalizers, and other reclosers. Isolates permanent faults to small parts of a system and thus cuts amount of patrolling required.

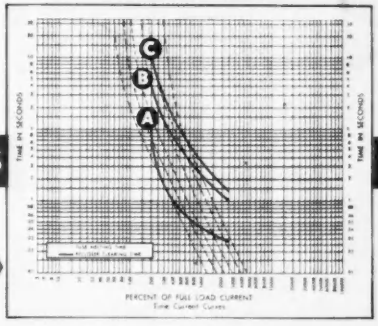
KYLE
TYPE 3H
Three-phase recloser

A practical combination of single-pole units so as to permit single-phase operation of any of the three-phase units so long as no lockout is required. If any one unit locks out, the other two lock out simultaneously. Prevents "single phasing" and overloading and burning out 3-phase motors.

7119



CHOICE OF 4 OPENING SEQUENCES



Curves show recloser action on each sequence:

1. Curve A—four fast openings.
2. Curve A and B—two fast, two retarded openings.
3. Curve C—four extra retarded.
4. Curves A and C—two fast and two extra retarded.

LM KK

For complete information ask the L-M Field Engineer or write **KYLE COMPANY** division of Line Material Company Box 2077, Milwaukee 1, Wisconsin

LINE MATERIAL Kyle Reclosers

Complete Coordinated Equipment for All Distribution Requirements

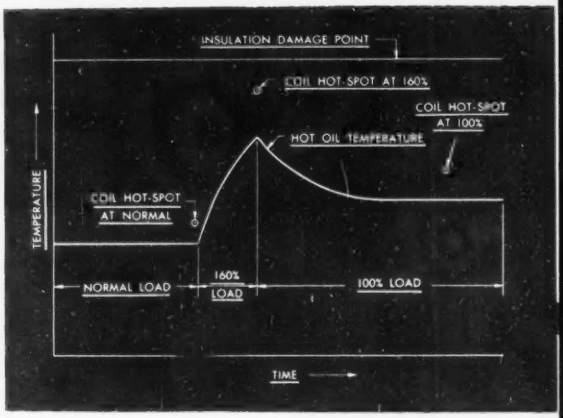
7119

high short time overload capacity because L-M "ROUND-WOUNDS" *have built-in cooling*

Obviously no transformer that develops hot spots because of insufficient coil ventilation will take much of an overload, even for a comparatively short time.

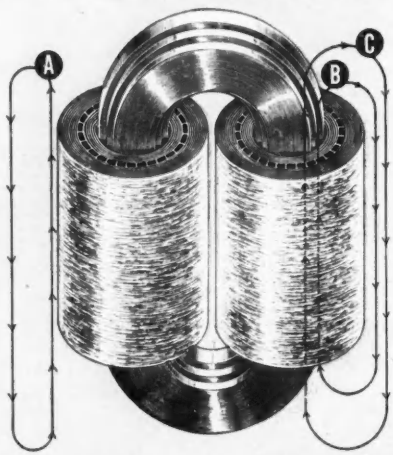
So, to assure real short-time overload capacity, L-M engineers designed a core which has inherently good coil ventilation characteristics. That's what we mean by a cooling system.

No—we aren't recommending Round-Wound 5 kva's for a 10 kva job! But we *do* say that you can expect long life, with an extra margin of short time overload capacity, because of the superior coil cooling of the Round-Wound design.



Typical time-temperature curve for Round-Wound transformers. ▶

The arrows in the illustration below show the flow of cooling oil



Arrows show oil circulation around and through the long round coils, and between core and coils. Exceptional cooling characteristics inherent in the L-M Round-Wound design assure you of unexcelled short-time overload capacity.

As the illustration shows, L-M Round-Wound design provides long round coils which expose more surface (A) to the oil than do shell type transformers. What's more, the Round-Wound design provides oil ducts between the cruciform core and the coils (B) to cool the inner windings. And in the larger sizes we build oil ducts right into the coil windings (C) for still more oil circulation.

How are you going to develop critical hot spots with that kind of cooling? Temperature gradient between windings and top oil remains low, and insulation is protected against damage under severe loading conditions.

Exceptional coil cooling results in high short time overload capacity—one of the several fundamental "Balanced Performance" characteristics found in all L-M Round-Wound transformers. Want more details? Ask the L-M Field Engineer or write Line Material Company, Transformer Division, Zanesville, Ohio.

ROUND WOUND 2 COILS 2 CORE

LM **LINE MATERIAL Transformers**

Complete Coordinated Equipment for All Distribution Requirements

L-M "Round-Wounds"

just don't leak!

. . . we've been using this "upside down" test to check transformer cover sealing since 1936

Recently there's been a good deal of interest in transformer tank sealing, with sealed tank construction incorporated in the Fourth Report of the EEI-NEMA Joint Committee on Transformer Standards.

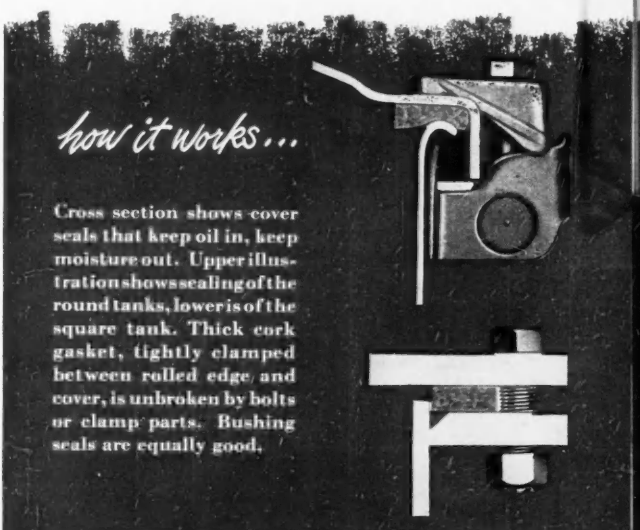
But tank sealing is an old story to Line Material. Years ago new customers were surprised because *we* shipped our transformers with the oil *inside*—not in a separate drum as others did. But our customers soon learned that the oil didn't leak out of L-M transformers because of L-M's original oil-tight tank and bushing seals.

Today L-M is recognized as one of the largest manufacturers of distribution transformers. L-M is also known as a leader in the development of *sealed tank* distribution transformers.

But it's not only the fact that the tanks on L-M "Round-Wounds" are sealed that's important. It's also *what* is sealed into the tanks that counts. In the L-M Round-Wound Transformer is the famous wound core that isn't cut, unwound, or disturbed in any way after annealing. There are the long, round coils wound directly onto the core. The design provides "Balanced Performance" with its many desirable characteristics—high short time overload capacity, excellent regulation, many other features.

You get more with "Round-Wounds." Why not get more information about them? Ask the L-M Field Engineer for the story—or write—**Transformer Division, Line Material Company, Zanesville, Ohio.**

The "upside down" test—another L-M "first"—long ago!



how it works...

Cross section shows cover seals that keep oil in, keep moisture out. Upper illustration shows sealing of the round tanks, lower is of the square tank. Thick cork gasket, tightly clamped between rolled edge and cover, is unbroken by bolts or clamp parts. Bushing seals are equally good.

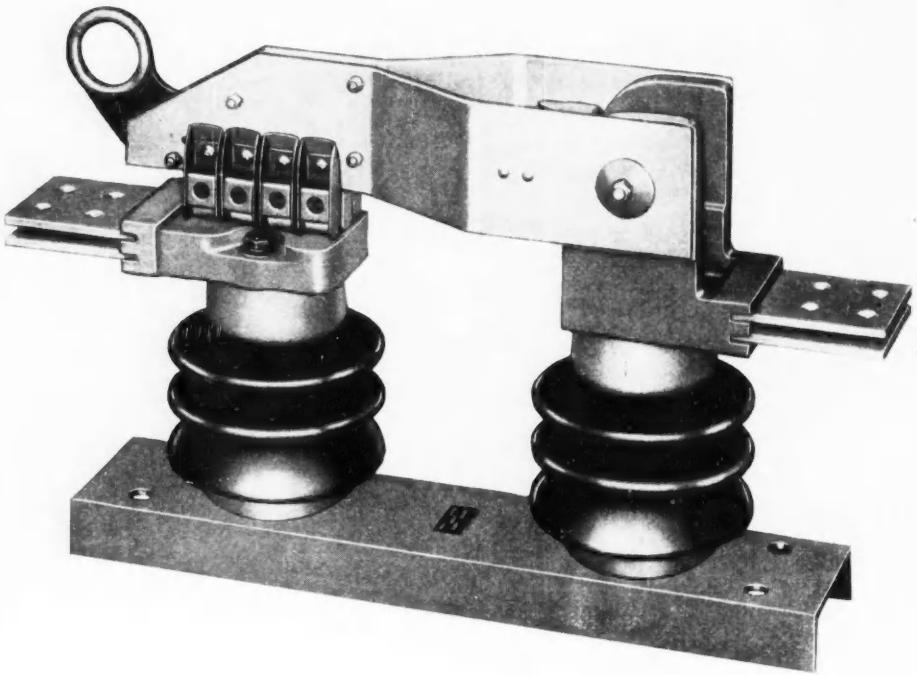
LM LINE MATERIAL Transformers

Complete Coordinated Equipment for All Distribution Requirements

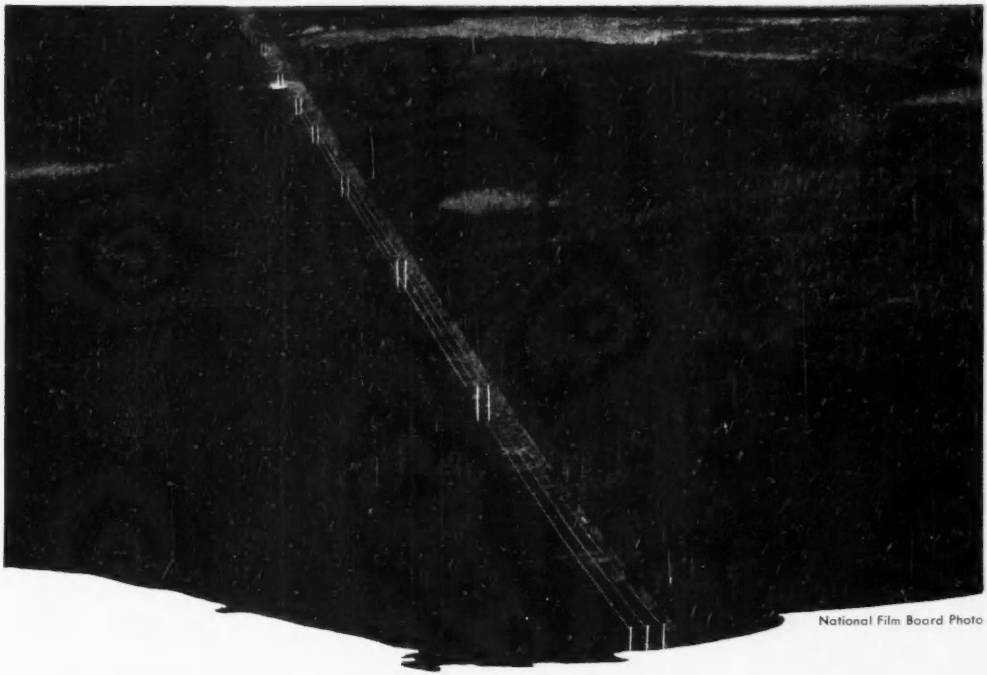
Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

TExas 0-4701



OUTDOOR HOOK STICK
DISCONNECTING SWITCH
Single Pole—Single Throw
7500 Volts—1200 Amperes
Type Y2 (Special Terminals)
See Bulletin 28



National Film Board Photo

WHERE THE GREAT BEAR SHIVERS AT 70° BELOW OR SIZZLES AT 120°

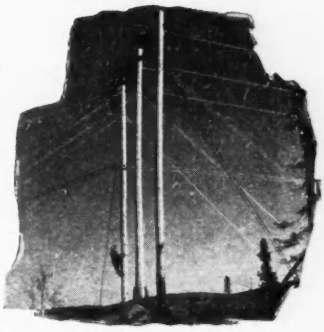
Fifteen hundred cold miles north of the Montana-Alberta boundary—a snowball's throw from the Arctic Circle—lies the Great Bear Lake region. Here, at the Snare River Power Development, the mercury dives to 70° below zero in the nine-month polar winter, but in the nearly continuous daylight of the short summer, temperatures boil up to 120° above.

Up there, cold contraction alone can jerk power lines to a singing tautness, or summer heat expand them to a gentle sway.

Stringing electric cable under those conditions posed two big problems when engineers wanted to adopt Aluminum Cable Steel Reinforced (ACSR). Would the line stand up under the temperature extremes and Arctic winds? How would you figure the sag and tension?

The answers were available. Sag-Tension data?—Yes! Thanks to a unique graphic method developed by Alcoa engineers for determining relation between "initial" (stringing) tension and "final" (after maximum loading) tension.

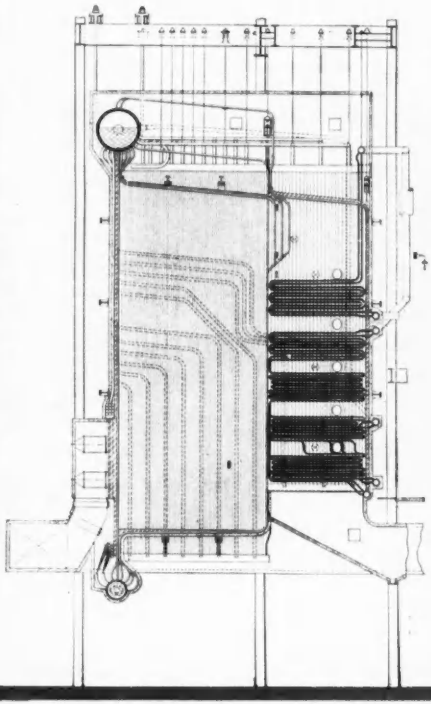
It's that kind of research that has pioneered Alcoa ACSR to the universal acceptance which it enjoys today. ALUMINUM COMPANY OF AMERICA, 2138 H Gulf Building, Pittsburgh 19, Pennsylvania.



ALCOA *Aluminum* CABLE AND ACCESSORIES

ALCOA ALUMINUM

A Million

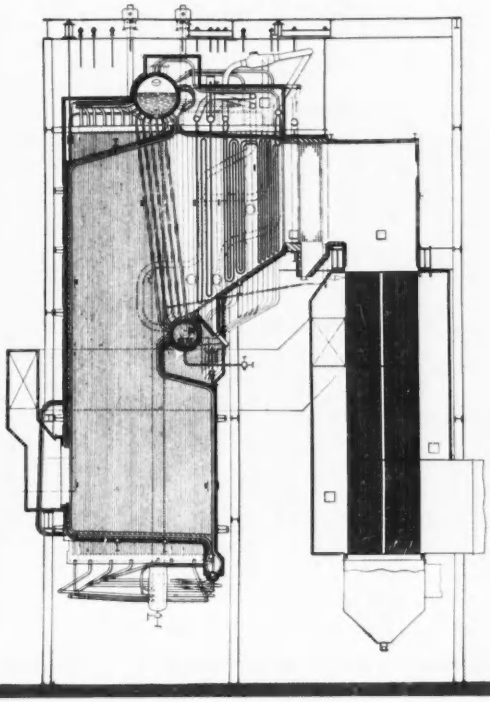


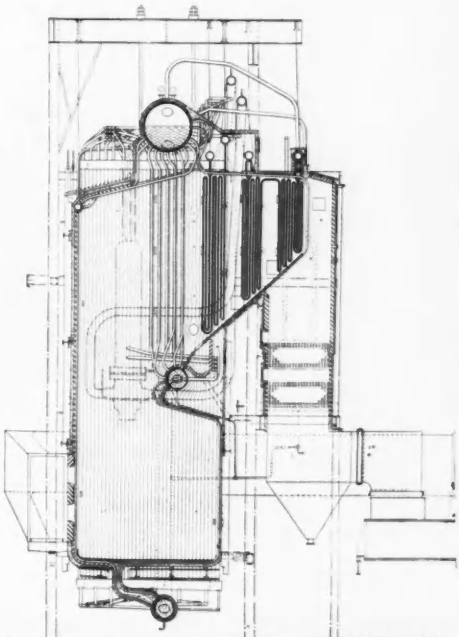
San Diego Gas & Electric Co.

One B&W Radiant Boiler of this design —575,000 lb. per hr. at 1475 psi, 950F —is on order for Silver Gate Station. Four other B&W boilers are now in service at this station.

...with B&W Steam

NEW Kilowatts for California





Pacific Gas & Electric Co.

Fourteen new B&W Radiant Boilers, eight of this design and six of a modified design have recently been installed or ordered for service at three stations: *Kern*—four 450,000 lb. per hr. units. (2 for 1500 psi at 935F, and 2 for 1550 psi at 935F): *Station P*—four 475,000 lb. per hr. units, 1550 psi at 960F; *Moss Landing*—six 475,000 lb. per hr. units of the modified design, 1550 psi, 950F. All units are installed outdoors and fired by oil and natural gas.

Southern California Edison Co.

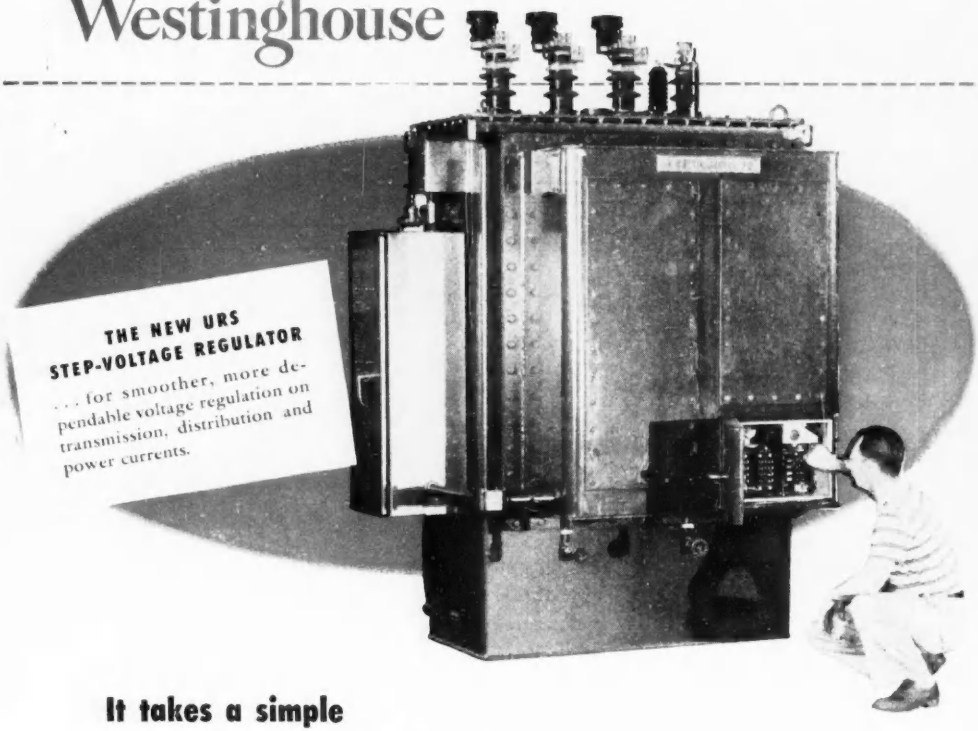
Seven B&W Radiant Boilers of this design—400,000 lb. per hr. at 1000 psi, 900F—have recently gone into service at the new Redondo Beach Station. All units are installed outdoors and fired by oil and natural gas.

BABCOCK & WILCOX

G-431

YOU CAN BE **SURE**.. IF IT'S

Westinghouse


THE NEW URS
STEP-VOLTAGE REGULATOR
. . . for smoother, more dependable voltage regulation on transmission, distribution and power currents.

It takes a simple

Direct Drive

for Lasting Dependability

Help increase the efficiency of your customers' electrical apparatus. Realize greater customer satisfaction *and* increased revenue! Give them economical, dependable voltage regulation with the new URS Step-Voltage Regulator . . . equipment you can count on for:

Lasting Dependability—because URS Tap-Changer provides *positive action*. The unusual simplicity of the direct-connected drive reduces potential trouble sources to a minimum.

Minimum Wear—because high contact speeds and contact tips of special arc-resistant alloys minimize erosion due to arcing.

Minimum Care—because wearing parts are carefully designed for longer life. All parts are readily accessible. The Tap-Changer may be inspected by removing conveniently located inspection plates.

There's a Westinghouse voltage regulator to meet every requirement. Get the complete story. Write for B-4245, C.S. 47-225, D.B. 47-310 and D.B. 47-410. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70531

Westinghouse

VOLTAGE REGULATORS FOR *ANY* SYSTEM

WICKWIRE ROPE

A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant—Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. &I.
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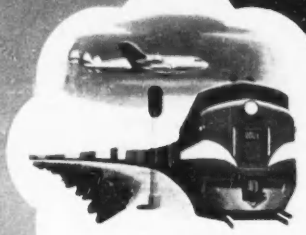
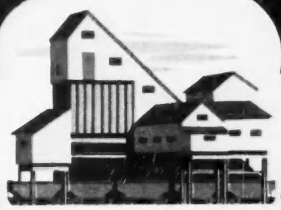
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1060—19th Ave., Oakland 6, Cal.

LOGGING

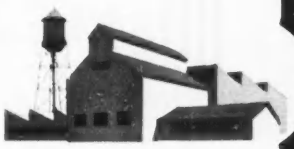


TRANSPORTATION

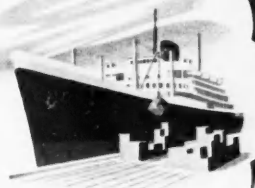


MINING

PETROLEUM



MANUFACTURING



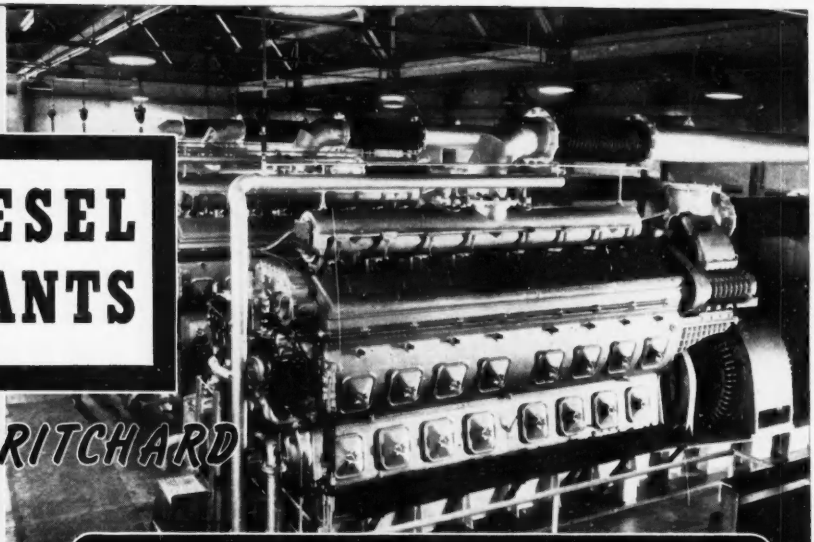
MARINE

CONSTRUCTION

A. L. Brotman

DIESEL PLANTS

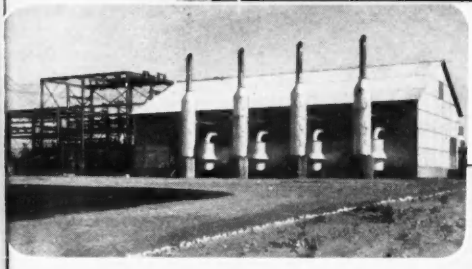
by PRITCHARD



MAXIMUM EFFICIENCY

at

LOWEST COST!



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THREE FUNCTIONS — Design, Engineering, Construction.

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FIVE FIELDS — Serving the CHEMICAL, POWER, PETROLEUM and GAS industries as well as providing specialized EQUIPMENT for all industries.

POWER DIVISION

J.F. Pritchard & Co.

DESIGN • ENGINEERING • CONSTRUCTION

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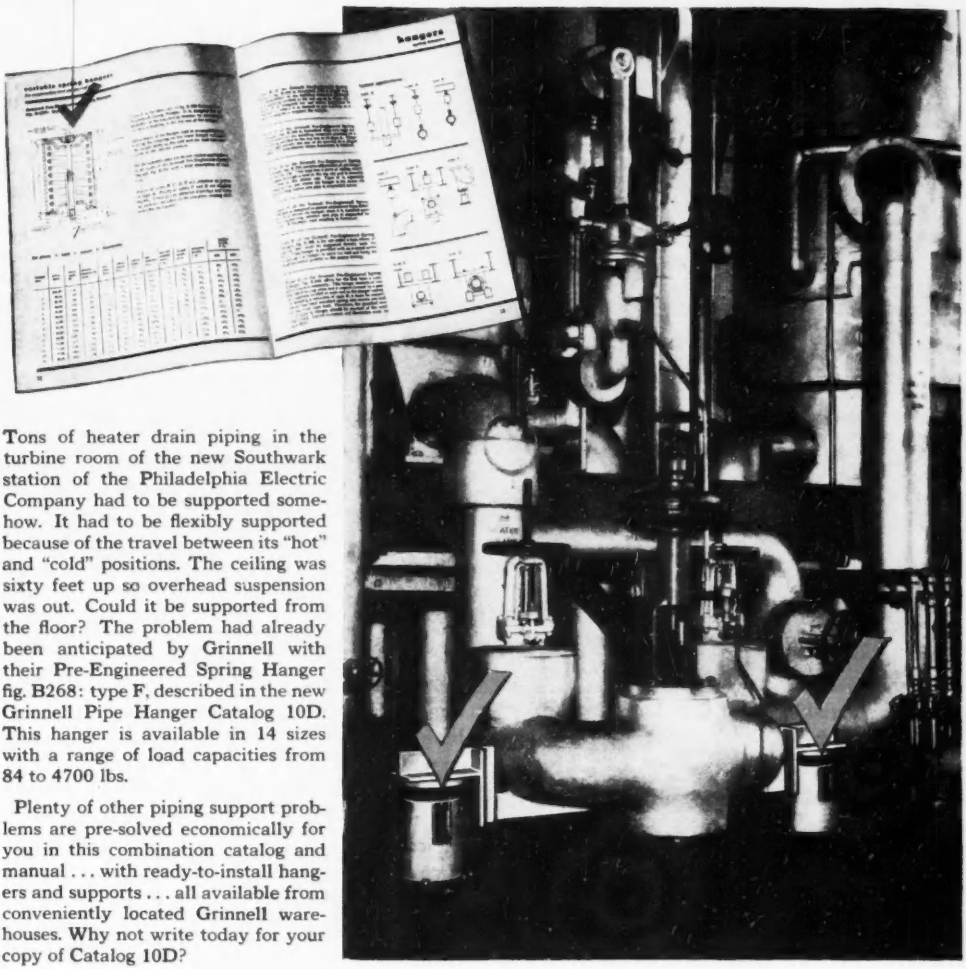
The problem was "special" but the solution came "out of stock"



Tons of heater drain piping in the turbine room of the new Southwark station of the Philadelphia Electric Company had to be supported somehow. It had to be flexibly supported because of the travel between its "hot" and "cold" positions. The ceiling was sixty feet up so overhead suspension was out. Could it be supported from the floor? The problem had already been anticipated by Grinnell with their Pre-Engineered Spring Hanger fig. B268: type F, described in the new Grinnell Pipe Hanger Catalog 10D. This hanger is available in 14 sizes with a range of load capacities from 84 to 4700 lbs.

Plenty of other piping support problems are pre-solved economically for you in this combination catalog and manual . . . with ready-to-install hangers and supports . . . all available from conveniently located Grinnell warehouses. Why not write today for your copy of Catalog 10D?

99 YEARS PIPING

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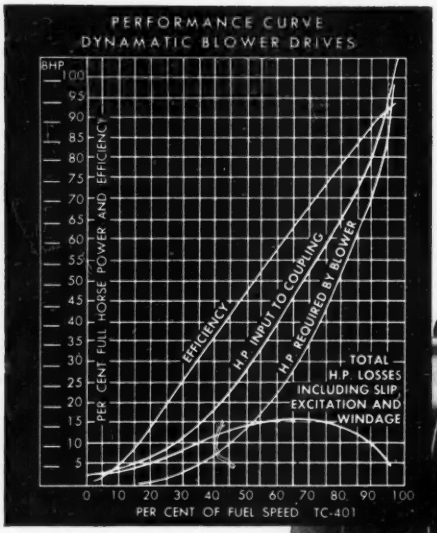
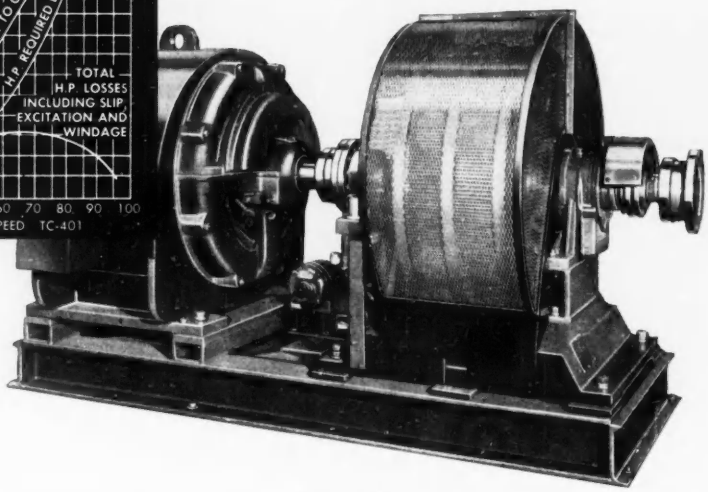


EATON DYNAMATIC BLOWER DRIVES



Instantaneous Response to Speed Control

Dynamatic Variable Speed Couplings are ideally adapted to such applications as regulating air drafts in steam generating stations, power house fan drives, public utility induced draft fans, and forced draft fans. Controls can be made to change the output speed of the coupling and hold that speed constant. Response is instantaneous and load changes are closely followed. The speed range available is practically infinite, and can be controlled precisely from ten per cent speed up to full speed.

The performance curve above indicates the characteristics of Dynamatic couplings when driving fans or blowers. Fundamentally, all fans and blowers will have curves very close to the ideal curves shown in this figure. Note the desirable relationship between efficiency, horsepower input, and required horsepower. The horsepower losses indicated are normal for this type of application. Both air cooled and water cooled types of Dynamatic couplings are available, selection depending upon loads and type of service involved. The electric-slip coupling was developed and introduced by Dynamatic; this company has pioneered the use of electric-slip couplings in fan and blower drive applications. Write for illustrated literature.

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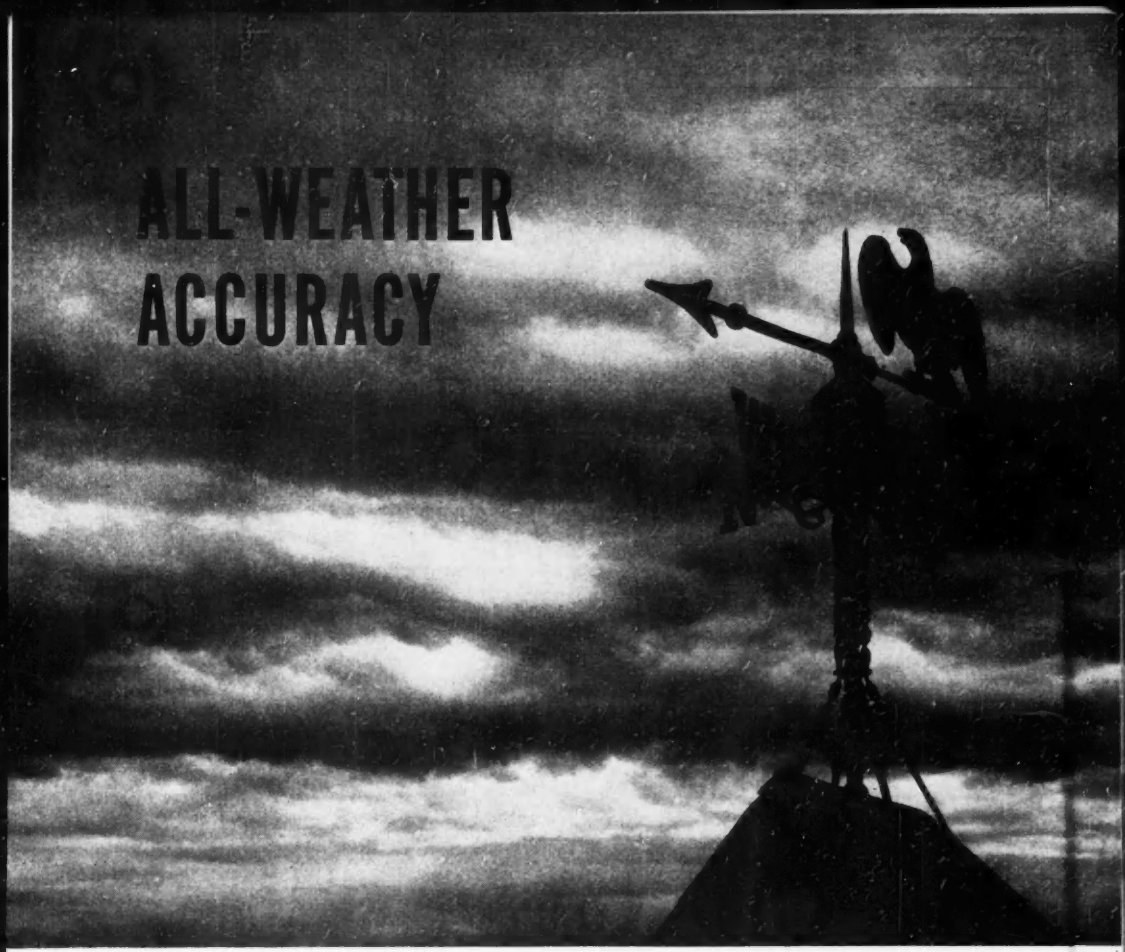
PRODUCTS: SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS • SPRINGTITES SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS



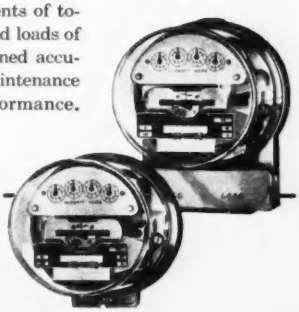
Sangamo J Watthour Meters

Even severe lightning disturbances leave the accuracy of your Sangamo J Meters unimpaired—9 years of field experience with millions of J Meters have proved this fact. Alnico magnets, shielded construction, and surge-resistant insulation are responsible for this "all-weather" accuracy.

The Alnico magnets used in J Meters have great power to resist the demagnetizing effects of lightning. They are clamped between aluminum frames which provide a conducting shield to further assure unusual freedom from loss of damping force by any cause. Sangamo J Meters are fully compensated for temperature extremes and accurately measure all power delivered at sub-zero or torrid temperatures.

* * *

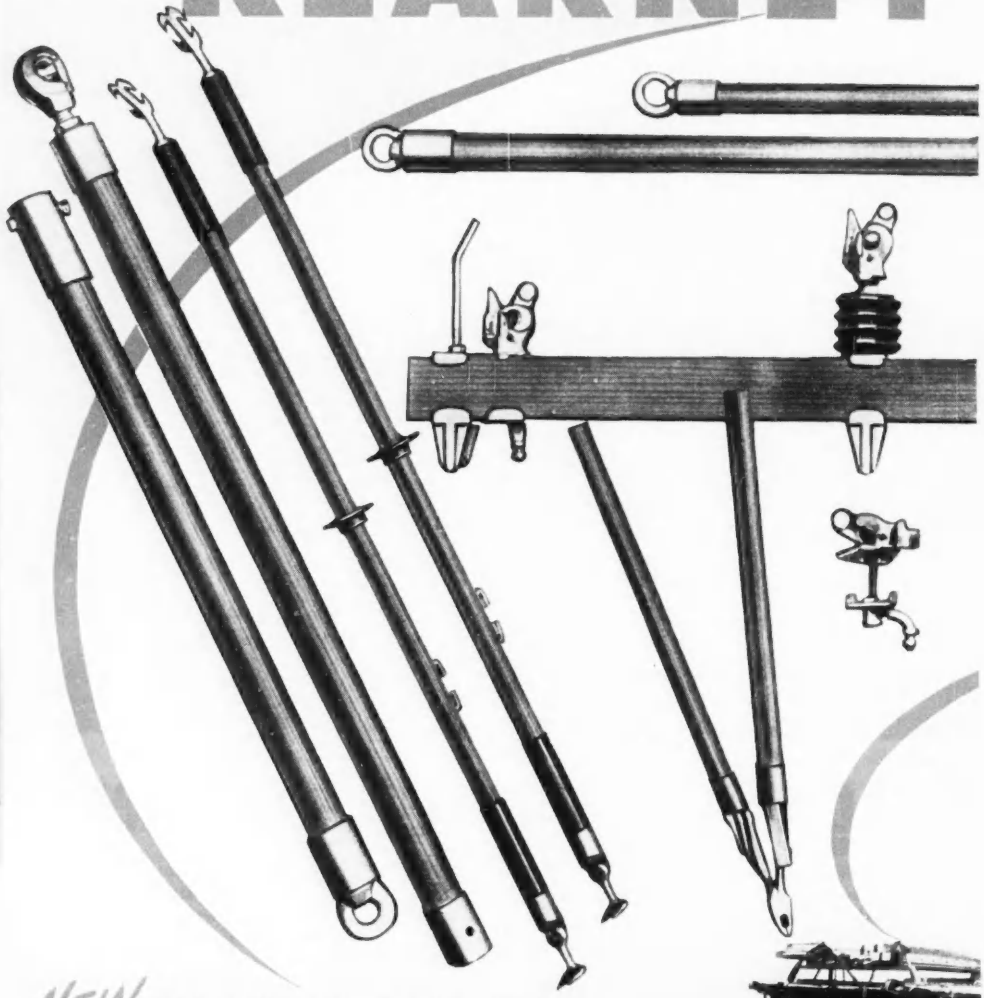
Sangamo J Meters have proved their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance and troublefree performance.



50TH ANNIVERSARY SANGAMO 1899 - 1949

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Use KEARNEY

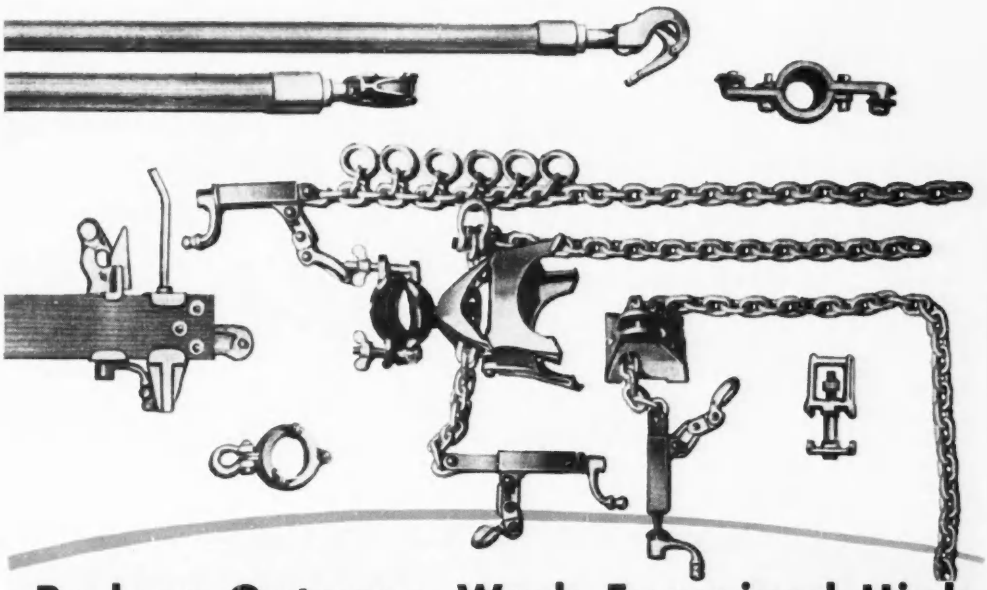


NEW KEARNEY HI-LINE Trailer

Keep HI-LINE TOOLS dry and prolong their service life in this new electrically heated trailer.

Designed to eliminate wasted space, you get greater storage area in this beautifully built, streamlined trailer, and you pay no more.

HI-LINE TOOLS



Reduce Outages, Work Energized High Voltage Lines — Safely, Efficiently

The key to outage reduction is often found in the tools you supply your hot line gang. Give them tools in which they have confidence, tools that have been field-tested for efficiency and safety, and you'll get better performance, save money and maintain better customer relations.

Kearney tools are available in sets or in individual units.

Write for prices and complete information.

JAMES R. KEARNEY CORPORATION
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Always Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job . . .*

JRK-141

Better Construction — *SAFER* Maintenance

All the facts of value favor

CHEVROLET ADVANCE-DESIGN TRUCKS

America's truck operators are wise buyers. They know the value of prime power with economy . . . of massive load capacity . . . of outstanding quality, durability and handling ease. They know the advantages of the latest and finest features and of greater driver comfort and convenience. And they know that *all* the facts of value favor Chevrolet trucks to an overwhelming degree . . . that they cost less to operate, less to maintain, and have the lowest list prices in the entire truck field. That's why they use Chevrolet trucks more than any other make!

CHEVROLET MOTOR DIVISION, *General Motors Corporation*, DETROIT 2, MICHIGAN

TOP-VOLUME PRODUCTION BRINGS YOU TOP-VALUE FEATURES!

Chevrolet's new 4-SPEED SYNCHRO-MESH TRANSMISSION offers quicker, quieter and easier operation. Double clutching is eliminated because the gears are always in mesh. Faster shifting maintains speed and momentum on grades. Available in series 3800 and heavier duty models.

Chevrolet's power-packed VALVE-IN-HEAD ENGINES provide improved durability and efficiency as well as the world's greatest economy for their size!

Chevrolet trucks have the famous CAB THAT "BREATHES"*! Outside air is drawn in and used air forced out! Heated in cold weather.

Chevrolet Advance-Design brings you the FLEXI-MOUNTED CAB, cushioned on rubber against road shocks, torsion and vibration.

Chevrolet's exclusive SPLINED REAR AXLE HUB CONNECTION adds greater strength and durability to heavy-duty models.

Unisteel, All-Steel Cab Construction • Large, Durable, Fully-Adjustable Seat • All-Round Visibility with Rear-Corner Windows* • Heavier Springs • Super-Strength Frames • Full-Floating Hypoid Rear Axles in the 3600 Series and Heavier Duty Models • Double-Articulated Brake Shoe Linkage • Hydrovac Power Brakes in Series 5000 and 6000 Models • Multiple Color Options.

**Heating and ventilating system and rear-corner windows with de luxe equipment optional at extra cost.*

CHOOSE CHEVROLET TRUCKS FOR TRANSPORTATION UNLIMITED! CHEVROLET

MAKES THE STARS SHINE BRIGHTER

LOOK FOR THIS NAME

It identifies aluminum reflectors made extra bright that won't chip, spall, or peel. Clean them regularly and they will last indefinitely. Leading manufacturers make Alzak reflectors in standard shapes and sizes, in specular and diffuse finish.

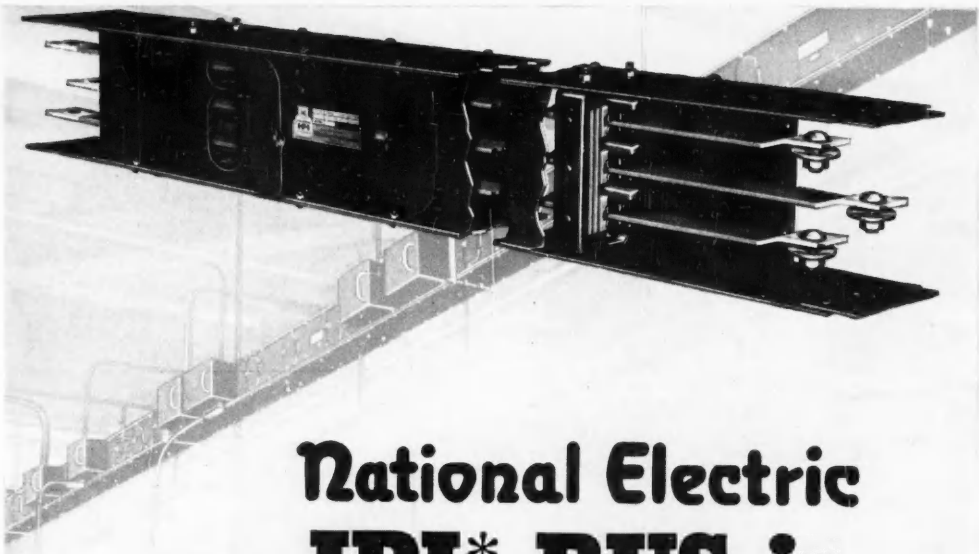
Television is a light-hungry business. It demands foot-candles by the thousand to sharpen the image, lend contour, increase depth of field. Television lighting is a job that Alzak reflectors handle well. They reflect and control light better than all other commercial reflectors.

What's that to you? Well, figure the price of wire, fixtures, current . . . everything for a lighting system. Poor reflectors can waste a lot of that money. Alzak reflectors give high lighting efficiency. ALUMINUM COMPANY OF AMERICA, 1978H Gulf Building, Pittsburgh 19, Pennsylvania.

ALZAK REFLECTORS
OF ALCOA ALUMINUM

ALCOA ALUMINUM

made by Leading Lighting manufacturers



National Electric IPI* BUS is EASY to INSTALL

CHECK THESE *ADDITIONAL* ADVANTAGES!

√ CONVENIENCE—

National Electric Plug-In Busway can be used to bring your present electrical distribution system up to date, or can be added to existing installations.

Plug-In openings, spaced 15" on center on two sides of Busway, permits mounting Plug-In Devices every 7½".

√ FLEXIBILITY—

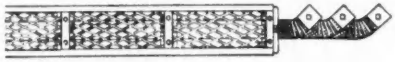
Busway can be mounted to permit installation of Plug-In Devices with standard ¼-20" screws on either side, or top and bottom.

√ ECONOMY—

Complete 100% salvability for alterations, additions, or relocation. Every foot of distribution system is usable.

***National Electric's Industrial Plug-In Bus is a completely self-contained electrical distribution system designed for quick, *simple* installation. Insulator bolts extending through the enclosure make suspension from ceiling or walls an easy job.**

Approved by Underwriters' Laboratories, Inc.



"Lo-Loss" Feeder Bus—specifically designed for transmission of current up to 4000 amp. at 600 volts or less. National **"Lo-Loss"** will do it economically and efficiently. Light in weight—compact in design. Easily installed because single bolt contacts are used.

Let us send you complete information. Write for our catalog "Busways by National Electric."

NATIONAL ELECTRIC PRODUCTS — WIRING SYSTEMS — WIRES AND CABLES

National Electric Products Corporation

1305 CHAMBER OF COMMERCE BUILDING • PITTSBURGH 19, PA.

Budgets for 1950

WHEN THE industry contributing 20% of the total construction activity of the country prepares its budget for 1950 it is of more than passing interest to America's future. The electrical industry's plans are tightly woven into the overall economy. First, because of the importance of industrial activity, farm production, home building, appliance purchases, etc, to electrical industry expansion; and second, because of the latter's sizable contribution to the total construction picture.

A change in inventory policy or construction activity by the electric utilities reacts down the line with accelerating effects.

In ELECTRICAL WORLD's "Forecast for Fifty," appearing in this issue, an attempt has been made to bring together background information to aid in planning for 1950. The major contribution was made by the McGraw-Hill Department of Economics in cooperation with the ELECTRICAL WORLD staff. Information on current trends in inventories, construction activity and load growth was generously supplied by 51 utilities.

From all these data it appears that the outlook is good. Load growth is even now passing through the valley toward higher hills on the other side. Following this will be expanding needs for electrical equipment and construction materials. Inventories have some further readjustment ahead, but this will not be extensive.

It now appears that some $2.3 billion will be spent by utilities and municipals in 1949. Add to this $360 million by electric co-ops and $80 million for electrical equipment by the Interior Department, and the grand total of $2,740 million is reached. In view of the predictions for a healthy economy in 1950, ELECTRICAL WORLD believes that the private utilities and municipals will need to spend $2.2 billion next year. Expenditures by electric co-ops will grow principally because of expansion in generating capacity to almost $400 million. With governmental projects going ahead on schedule, it appears that no material reduction in total construction is in sight.

That the industry will be able to continue to finance the expansion is indicated by current earning records. Reports for recent months show gross income gains of 12%, compared with property additions of the same percentage. Significant among the changes in operating expense is the reduction in fuel cost of 7% in a month like April in spite of a gain of 4.4% in fuel consumed.

These are some of the general conclusions that may be reached from the available industry data. We hope that the detailed analysis presented herein will give the electrical industry substantial aid in making policy decisions on next year's budget, for—the decisions which utility managements make are important to the industry and to the country.

Power Industry's First Break

AS THE FIRST step toward admission of the power industry into the atomic energy field, David E. Lilienthal on Oct 6, 1947, announced the formation of a Board of Consultants having two initial purposes:

First, to aid the Atomic Energy Commission in attaining the earliest possible practical application of atomic energy by private business, and

Second, to place the consultants in a position, within security limitations, to keep American industry informed of developments in the Commission's widespread research and development activities.

On Dec 30, 1948, this board, under the chairmanship of James W. Parker, president of the Detroit Edison Co, presented a report stating that "there is an unmistakable need for greatly expanded participation by industry in atomic energy development."

The report recommended that such results could be obtained by "(1) providing industry with much useful information about atomic energy, (2) greatly increasing direct personal contacts between men in industry and the atomic energy project, (3) setting up and making effective use of various kinds of industrial advisory committees, (4) further strengthening the contract system, and (5) perfecting the Commission's form of organization so that it will be in a better position to deal effectively with industry."

Now this forward-looking recommendation of the Parker committee has been acted upon in a constructive manner. On Aug 14, the AEC established a three-man temporary Advisory Committee to make recommendations as to the most practical means of establishing effective continuing contact, within security limits, between the Atomic Energy Commission and the electric power industry.

Not only is this program constructive, but it also has been implemented by an excellent committee. For chairman, AEC selected Philip Sporn, president of American Gas & Electric Co, a recognized broad thinker and superb engineer; and as committee members E. W. Morehouse, vice-president of General Public Utilities Corp, with broad industry and management training; and Walton Seymour, who is well qualified to represent the governmental viewpoint.

With an able committee working on such a worthwhile project, the industry should feel cheerful about future prospects. It is expected that by the date set for completion of the Committee assignment, March 31, 1950, the following objectives provided under the "Terms of Reference" will be reached:

1. Recommendation of membership for a continuing advisory body made up of the ablest men from the power industry.

2. A program providing a means of utilizing technical personnel of the electric power industry.

3. A plan to give appropriate representative groups and technicians in the industry a correct understanding of the problems involved.

With these objectives accomplished, the committee can assure rapid developments in the field of atomic power for electrical generation. Of no less importance is the opportunity for the industry to prevent the socialization of atomic power and to assure adequate public information on its relative value in terms of other sources of energy.

Coal or Wood May Be Cheaper

SOMETIMES the industry is too gentle with competition. But one member has spoken direct from the shoulder about bottled gas. That man is George Kable, editor of *Electricity on the Farm*. Here's what he had to say in a recent editorial:

"Any fuel that burns, such as bottled gas, uses the oxygen from the air of kitchens, brooder houses, etc. It adds carbon dioxide (such as you exhale in breathing) and humidity to the room air. Frequently there is some gas liberated in the room. These are not good conditions for either livestock or humans. . . ."

"Bottled gas may appear to be cheaper. Sometimes it is. But, check your electric rate carefully. The rate for cooking and additional uses will not be the same as what you pay for just lights and a few appliances. You will get the benefit of the lower blocks in the rate. . . ."

"Coal or wood may be cheaper than either gas or electricity. A bicycle or a pair of walking shoes also cost much less than an automobile. You use electricity for convenience, safety, ease and nicety of control, for its many uses to save labor, make money, produce better products, and to improve your standard of living in the community. . . ."

These appear to be solid points for the salesman who would lay to rest the new fuel that has replaced coal and wood as electricity's main competitor in the rural market.

Utilities Are Monopolies

IT WAS RECENTLY reported in an article appearing in *Public Opinion Quarterly* by A. A. Imberman that "at least two-thirds of our adult population regard private utility companies dubiously and suspiciously." The reason given is that public utilities are widely regarded as monopolies. It seems that Mr. Imberman wants the utilities to do something about this attitude of the common man.

It is difficult to see what can be done except to tell this so-called common man what a nice guy that monopoly is. Certainly no one can change those regulated monopolies into competitors without bankrupting them.

So it would appear that the current activities of ECAP along with the local utility programs are definitely on the right track. They are both pointed toward giving the public a thorough understanding of the business.

The Electrical Week

Advertising managers of electric utilities, who will be the men behind the industry's big selling campaigns of the coming year, are wrestling with their budgets. As a source of authority they are using the survey prepared by the Public Utilities Advertising Association. The survey shows just how much the utilities spent per customer and in percent of gross income. A breakdown explains how the advertising dollar was divided . . . Nebraska Public Power System, unable to get all the federal funds it needs, is turning to private capital in order to continue its expansion program . . . The Senate this week dealt the private utilities a hard blow. It restored the funds which the Senate Appropriations Committee had denied the Southwestern Power Administration pending wheeling agreements with private utilities. The Senate ignored the possibility of wheeling agreements.

Rep Emanuel Celler, New York Democrat, has recessed his House Judiciary Committee's investigation of insurance company investment practices. But he will resume them in October, when he will enlist the aid of the Securities and Exchange Commission and Federal Trade Commission.

Georgia Power Co is out to win the support of the state's fishermen. In order to provide an ample catch at its dam near Albany, the company will build a hatchery to provide a million fish annually for the reservoir.

Congress has given up hope of reducing excise taxes this year. But all excises, including the 3.3% energy tax, will definitely be reviewed early next year, Congressional leaders promise.

Allis-Chalmers Manufacturing Co has built a mechanical kidney and will donate it to the City of Milwaukee. The device is designed to double for human kidneys when they have temporarily ceased to function. It is expected to save the lives of about 20 Milwaukeans each year.

Reductions in Securities and Exchange Commission's appropriations for fiscal 1950 forced that agency to dismiss 58 staff members. Of these 20 were in the Utilities Division.

Despite popular opinion, lobbyists are popular with members of Congress because of their usefulness. The lobbyist spends much of his time answering queries from Congress or government agencies, filling them in on the meaning of proposals and legislation which the legislator hasn't the time to investigate first hand. To get to the nub of any controversial matter, the legislator merely checks the story told by one group of lobbyists against those told by the others.

The CIO United Electrical Workers, already holding a dubious status in the CIO because of its opposition to some CIO policies, has been suspended from the Canadian Congress of Labor. The charge: UE officials have constantly opposed CCL policies.

In Arizona recently an airplane and a train teamed up at the expense of the Arizona Power Co. The plane knocked down a 4-wire transmission line, including a 44-kv; the train sliced the wires which had fallen across the track.

Gov W. Kerr Scott of North Carolina has threatened that if electric utilities and telephone companies do not expand services to meet needs of rural areas their franchises will be withdrawn. But he admits that this might result in lengthy court action.

Electric energy production for the six months of 1949 was 143,467,865,000 kwhr, an increase of 4.5% over the corresponding period of 1948.

Lest we forget, 10 years ago this month the Tennessee Valley Authority took over the properties of the Tennessee Electric Power Co.

Notes From The News

Reaching a crest of 8.3 ft above mean low water mark, flood waters of the James River on Aug 17 wrecked eight Virginia Electric & Power Co floodgates regulating water flow into the spillway to Richmond's canal. Company engineers were unable to lift the gates ahead of the rising waters because vandals had hammered in the keyholes. Damage to the gates did not interfere with other power company operations. . . Employers are becoming increasingly aware that the seeming disability of physically handicapped and older employees is frequently more than offset by consistently good job performance, steadiness and reliability, lower personnel turnover, and a lower incidence of absenteeism, a survey by the

Continued on following page

EQUIPMENT MOVES to construction site on $3-million Seattle, Wash., municipal hydroelectric project by means of an especially built 30-deg, 1,800-ft cable line across Skagit River and up a steep cliff. Bulldozer shown here weighs 10 tons. The project includes a new 60,000-kw unit scheduled for operation by September, 1951

Chamber of Commerce and the National Association of Manufacturers has revealed. . . Twenty-one percent of all Ohio Public Service Co employees had their ideas for improvement of service accepted between September, 1943, and June 30, 1949. Average suggestion award was $9.98.

Cleveland Electric Illuminating Co has issued to its employees a 68-page booklet as a guide for safe working practices. . . Color television got its first intercity public broadcast last week in Washington. Using the same facilities as for black and white transmission, experimental tests from Johns Hopkins Hospital in Baltimore to the National Guard Armory were shown to members of the Federal Communications Commission, other government officials, members of Congress, and the press. Object of the show, sponsored by a Philadelphia pharmaceutical manufacturer, was to get FCC authorization to broadcast surgical operations in color from Johns Hopkins to the American Medical Association's midseason meeting in Washington early next December. . . Virginia Electric & Power Co is selling off-peak water heaters at the rate of slightly less than a thousand a month.

Ontario is getting ready to impose restrictions on power use similar to those in force last year if they should be needed, but the province's Hydro-Electric Power Commission is hopeful that they may be avoided this fall. In any case, there won't be any cuts after this year, Premier Leslie Frost has promised. . . New Brunswick, on the other hand, is looking for the annual shortage of hydro power in the maritime provinces to develop earlier than usual this year, in early September. A long sustained drought has cut water storage volume to a record low. Industrial plants have had to curtail production operations. . . Stockholders of Gulf States Utilities Co will vote on authorization of 60,000 additional shares of preferred stock at a special meeting, Sept 27, in Beaumont, Tex. Proceeds of the sale to insurance companies would be applied to the cost of the 1949 construction program. . . Virginia Electric & Power Co suggests that dealers with an oversupply of refrigerators taken as trade-ins recondition them and sell them to low-income families, using the coin-meter system.

Manufacturers & Markets:

Cutler-Hammer, Inc, Milwaukee, Wis., has licensed British V. S. F. Co. Ltd, Keighley, Yorkshire, England, to manufacture its line of appliance, tool handle, automotive and aircraft switches for European distribution. This licensing arrangement was made through the Igranic Electric Co, Ltd, of Bedford, England, for many years a Cutler-Hammer associate in the manufacture and sale of motor control and other heavy duty electrical apparatus. . . . Scovill Manufacturing Co, Waterbury, Conn., returned to its regular policy of pricing orders at the time shipment is made, effective Aug 9. Since July 6, the company has been granting firm prices. "We sincerely believe our policy of pricing mill products at our prices prevailing the date we make shipment", said the announcement, "is one that makes for more stable prices. . ."

AEC asked construction bids last week on what is expected to be the first plant to produce "significant" amounts of atomic power. Dr C. G. Suits, vice-president of General Electric, which is designing the plant, said bids were asked for the first units of the experimental plant near West Milton in Saratoga County, N. Y. They will form part of the Knolls atomic power laboratory operated for AEC by the GE research laboratory. . . Westinghouse has started to step up production on refrigerators 50%. The company had cut back output 50% in June. The new production rate will be continued until the beginning of October, when a gradual production changeover to 1950 models will begin.

Budgets Fret Utilities' Ad Managers

They Study PUAA Survey to Determine How Much a Utility Should Spend for Advertising; Allocation of Items of Expense Equally Troublesome

FOR OVER A YEAR the electric utility industry has been screaming, figuratively speaking, that the future of the industry depends upon selling. This has been a repetitious theme at meetings of national, district, and state associations. The industry has been warned that the output of the many new generating plants must be sold, that more appliances must be sold, that manufacturers must use more power, and that there must be more Planned Lighting.

And the men who indirectly will do this selling, the advertising managers, have been going quietly about their business. To them selling is easy. Their problem is to get from management a satisfactory budget. This is difficult because it is hard to prove results, which may not be immediately apparent, and because the method of allocating advertising budget items depends much on opinion and somewhat on local conditions.

The advertising managers through their association, the Public Utilities Advertising Association, have been trying to obtain more data so that a more scientific approach to their budgetary problems can be made. For three successive years a PUAA committee, headed by Clarence L. Law, vice-president of Consolidated Edison Co. has been surveying utilities to find out how much they have been spending for advertising and in what way they have spent their advertising budgets.

The New York utility executive has contributed the services of his vast research organization and has been assisted by Henry Obermeyer, director of advertising for his company.

That the advertising managers are sold on this approach to their problems was demonstrated at their last annual convention at Cincinnati. A motion to discontinue the annual advertising cost survey was defeated by an overwhelming margin. Preparations are already being made for the fourth survey.

Since PUAA draws its membership from electric, gas, and combination companies, all are represented in its surveys. In 1947, a total of 135 companies, representing about 53% of all electric and 54% of all gas users in the United States, replied to the survey. In 1948, 180 companies responded. These served 59% of the electric and 66.3% of all gas customers. PUAA claims that all but 43 of the larger companies (those having $5 million gross income or more) have been included in the report.

The increase in the number of companies has a tendency to distort comparisons between 1948 and 1947. But the results for 1948 naturally present a truer picture. They show that in 1948 utilities spent more for advertising per customer but in percent of gross revenue there was little change from 1947 (see table). Combination companies when weighted as to electric and gas customers were the poorest advertisers. This may be due to the lack of competition which straight electric and gas companies meet.

When it comes to analyzing how the advertising dollar was spent, little variation is found between 1947 and 1948 in the distribution of major advertising expenditures. (See Table). For the industry as a whole, newspaper space still gets most of the advertising dollar, 32.2% in 1948 against 31.6% in 1947. Salaries are up to 11.3% from 10.8%. Radio, even with television added, is down to 7.8% from 9.2%.

One of the big changes from 1947 to 1948 was in the percentage spent for house organs, down to 4.8% from 6.1%. This can be explained by the inflexibility of this expense. To publish a good house organ, a utility must spend a certain basic sum.

In commenting on the results of the survey, PUAA is as cautious as the American Medical Association in endorsing a new drug.

"For the first time it now becomes possible to establish—though perhaps it is not quite yet discernable—a trend line in certain directions. We hesitate somewhat even to call attention to this, because its significance, if any, must be tempered with much qualification," Obermeyer told the PUAA convention. But the advertising managers have high hopes that the fourth survey will provide the results they are seeking.

Utilities Advertising Expenditures 1947 versus 1948

Dollars of Advertising per Customer

	1947			1948		
	Avg	Max*	Min*	Avg	Max*	Min*
All Companies	0.59	2.28	0.07	0.62	4.09	0.07
Electric	0.76	1.89	0.24	0.82	2.41	0.17
Combination	0.56	1.45	0.22	0.57	2.05	0.12
Gas	0.48	2.28	0.07	0.56	4.09	0.07

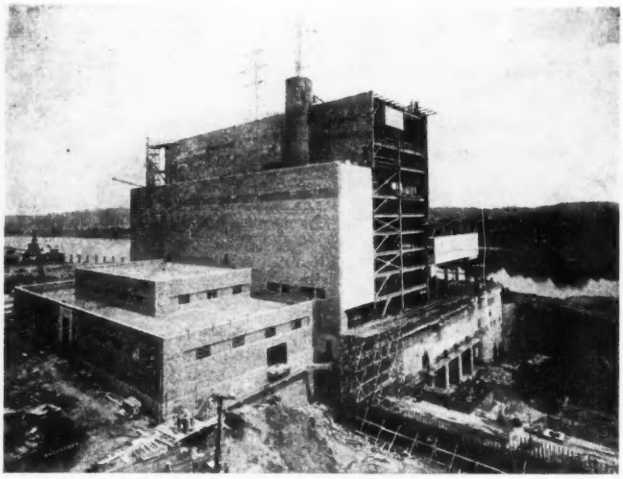
Total Expenditures as % of Gross Revenue

All Companies	0.60	3.21	0.10	0.60	4.13	0.10
Electric	0.61	1.82	0.23	0.62	1.99	0.17
Combination	0.58	1.55	0.20	0.54	1.92	0.10
Gas	0.70	3.21	0.10	0.79	4.13	0.10

* Maximum and Minimum for individual companies

Percentage Distribution of Total Advertising Expenditures

	All Gas and Electric Utilities		Electric Utilities		Combination Utilities		Gas Utilities	
	Percent of Total Adver Expenditures		Percent of Total Adver Expenditures		Percent of Total Adver Expenditures		Percent of Total Adver Expenditures	
	Average		Average		Average		Average	
	1947	1948	1947	1948	1947	1948	1947	1948
Newspaper Advertising Space	31.6	32.2	33.2	32.1	31.7	32.8	28.3	30.7
Prod. Cost for Newspaper Adver.	4.8	5.3	5.0	4.4	5.1	6.2	3.6	4.4
Radio and Television	9.2	7.8	8.5	9.0	9.9	8.3	8.4	4.8
Billboard and Poster	5.0	4.2	4.5	4.0	4.1	3.5	8.6	6.4
Direct Mail	2.4	2.9	3.5	3.5	2.0	1.9	1.9	4.3
Window and Showroom Display	3.2	3.5	3.0	3.1	2.8	3.6	5.0	4.0
Exhibits and Fairs	2.7	2.9	3.2	4.8	2.3	1.5	2.9	3.6
Motion Pictures	1.2	1.1	2.2	0.7	0.5	0.6	1.4	3.1
Miscellaneous Catalogues	1.2	1.8	1.4	1.1	1.0	1.6	1.6	3.4
Dealer Helps	0.7	1.2	0.7	0.6	0.6	0.6	0.8	3.4
Employee House Organ	6.1	4.8	4.6	5.1	7.6	4.6	4.3	4.8
Bill Inserts	3.4	4.3	3.5	5.2	3.7	4.7	2.0	2.1
Stockholder Annual Reports	2.9	3.5	2.6	3.7	3.8	4.1	0.9	1.4
Salaries	10.8	11.3	9.2	9.8	11.9	13.0	10.1	9.5
Stationery and Office Supplies	2.1	0.8	1.6	0.7	1.6	1.0	4.7	0.5
Association Advertising	7.7	7.4	7.4	6.6	7.2	7.3	9.8	8.6
Electric	(5.3)	(4.9)	(7.4)	(6.6)	(5.7)	(5.8)	....	....
Gas	(2.4)	(2.5)	....	....	(1.5)	(1.5)	(9.8)	(8.6)
Agency Commission	1.6	1.4	2.2	1.3	1.1	1.4	2.2	1.8
Surveys	0.3	0.7	0.2	1.0	0.4	0.6	0.0	0.3
Other Advertising	3.1	2.9	3.5	3.3	2.7	2.7	3.5	2.9
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



CONSTRUCTION is progressing rapidly on 550,000-kw Philip Sporn Plant at Graham Station, W. Va., jointly owned by Ohio Power Co and Appalachian Electric Power Co. The first 137,500-kw, 2,000-psi, 1,050 F (1,000 F reheat) unit is planned for service in November; second, in 1950. Work on Units 3 and 4 is under way at right. Towers atop the plant support 132-kv leads running from step-up transformers between the plant and the Ohio River to an outdoor switching station. Unit 1's stack is only partially completed

Nebraska Public Power System Seeks Private Capital for Expansion

AFTER A YEAR of only partially successful negotiations for more federal funds, the hard-pressed Nebraska Public Power System will seek private capital for its expansion program.

The decision came after the Loup River public power district, a part of NPPS, obtained an $8,412,000 loan from the Rural Electrification Administration for generating and transmission facilities. NPPS also had been seeking additional money from the Federal Works Agency, which holds some $40 million in the system's bonds covering previous federal loans.

With no funds available for further loans, FWA rejected the NPPS application, it was reported. But FWA officials agreed to waive restrictions in the present bond agreements against other types of financing. The waiver arrangement, which probably will give private bonds and the REA debt equal status with the federal bonds, apparently has not been completed as yet.

The REA loan provides the Loup district with $3 million to complete its 60,000-kw steam generating plant at Bellevue, Neb., and transmision lines connecting the plant with the NPPS system. The remaining $5,412,000 will finance 317 miles of 115-kv and 23 miles of 69-kv transmission lines and switching and substation facilities.

The latter lines will be incorporated in the NPPS primary transmision system. The Bellevue plant, with two 30,000-kw generating units, will be linked to the NPPS system by a five-mile transmission line to Omaha.

REA approved the loan as a means of obtaining better service for 27 of its borrowers — cooperatives and rural power districts — purchasing energy from NPPS. The lending agency also wangled what it termed "participation in the management of NPPS" for its Nebraska systems.

This arrangement apparently affected the NPPS negotiations with the Interior Department for energy from the Missouri Basin hydroelectric projects nearing completion in the area. After wrangling with rural systems over division of Nebraska's share of this energy, NPPS submitted a new proposal to Interior, purportedly recognizing the requirements of the REA borrowers. Terms of this proposed contract have not been revealed.

REA reported the power shortage in Nebraska is "still critical." It pointed out that NPPS has been forced to curtail irrigation loads during the summer in order to meet the requirements of other power consumers.

•

Prospects for Color TV Depend on 2 Reports

The prospects for early introduction of commercial color television should shape up pretty clearly by the first of the year. By that time results of two official reports on the subject will be released in Washington, one from the Federal Communications Commission, the other from the National Bureau of Standards.

Behind the latter report is Sen Edwin C. Johnson, Colorado Democrat, who is critical of FCC's progress in speeding the spread of television.

FCC's report will be based on the results of official hearings scheduled for late September. These hearings will cover two points: one, the feasibility of expanding telecasts by allocating to TV new frequencies higher up on the radio spectrum. The other is the practicability of transmitting color broadcasts so that present commercial receivers can receive them in color with a minimum of adjustment or adaptation.

The NBS report will cover the same points in addition to the possibility of adapting present receivers to pick up color broadcasts in black and white, as well as color.

But regardless of the outcome of these reports color TV is still at least two years away.

•

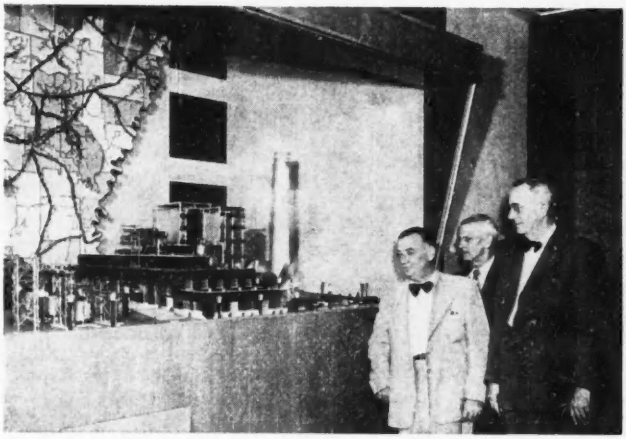
Co-ops Exempt from Tax

Rural electric cooperatives in Kentucky are not subject to the state income tax, Assistant Attorney-General Hal Williams has ruled in an opinion sent to Joseph C. Swidler, general counsel for the Tennessee Valley Authority. Instead the law requires co-ops to pay the state $10 a year in lieu of all state taxes except property and franchise levies.

•

$1-Million Loan Made

The two hydroelectric districts composing Nebraska Public Power System have received a $1-million loan from Consumers Public Power District, Columbus. The sum will go into the system's hydro expansion program while its refinancing plans are being completed.



EXACT IN SMALLEST detail is a glass-enclosed miniature of Arkansas Power & Light Co's 100,000-kw Cecil Lynch Station placed on exhibit in the Arkansas Capitol. Secretary of State C. G. Hall, left, inspects the model with its designer, Frank Beale, center, superintendent of the utility's Underground Department in Little Rock, and AP&L Vice-President R. E. Ritchie. Background is a company system map with photographs of other AP&L installations. Lighting effects include a complete darkness-to-daylight cycle with especially arranged spotlights

Senate Votes SPA Funds, Scraps Wheeling Agreement Suggestion

EFFORTS of a Senate committee to promote government-power company wheeling agreements in place of federal transmission lines failed this week. The stormy debate touched off by the proposal made it extremely doubtful that the utility industry can look for any compromise of its disputes with federal power agencies during the tenure of the 81st Congress.

The argument over wheeling agreements, which the Senate Appropriations Committee urged the Interior Department to seek with several power companies, ended Aug 23 after nearly a month of debate. The critical vote came when the Senate restored funds, cut by the Senate committee but previously approved by the House for fiscal 1950 expenditures by the Southwestern Power Administration. These funds were replaced by a 45-36 vote.

The Appropriations Committee reduced SPA's construction budget for 1950 from the $9 million in cash and contract authorizations approved by the House to a total of $3,874,020. The funds thus slashed, the Committee said, would be unnecessary if SPA accepted contracts offered by utility companies in the Southwest.

The Senate vote on SPA also heralded the defeat of similar Committee proposals that the Reclamation Bureau and Bonneville Power Administration make wheeling agreements with companies in California, Idaho, Montana, Colorado, and Oregon. The House previously had voted the latter agencies funds for transmission facilities which companies in those areas opposed.

Nine Republicans joined with 36 Democratic Senators to restore the Committee's reductions in SPA's budget. They were Senators Knowland, California; Langer, North Dakota; Malone, Nevada; McCarthy, Wisconsin; Morse, Oregon; Smith, Maine; Tobey, New Hampshire; Wiley, Wisconsin; and Young, North Dakota. Ten Democrats and 28 Republicans voted to sustain the Committee's recommendations.

But only one Senator, Oklahoma Democrat Thomas, made a serious fight against opponents of the Committee. Meanwhile, a parade of Senators, led by Democrats Kerr of Oklahoma and Johnson of Texas, denounced the proposed cut in SPA funds.

The debate clearly outlined the issues involved. Senator Thomas pointed out repeatedly that the Appropriations Committee was urging SPA to make agreements similar to the contract it made voluntarily a year ago with Texas Power & Light Co. If the negotiations failed, he added, SPA was instructed to so report to Senate and House Appropriation Committees next January. In that case, he said, supplementary funds would be authorized to allow SPA to build the disputed transmission facilities.

But opponents of the plan charged that the power companies proffered wheeling agreements only after the House had voted Funds for numerous Interior Department transmission lines. They hinted that the companies might withdraw the offers if the transmission money was withheld by Congress.

•

Tennessee Co-op Officer Gets Agriculture Post

Appointment of Knox T. Hutchinson as Assistant Secretary of Agriculture gives new representation in the federal government to rural electric co-operatives. Hutchinson, an organizer and officer of Tennessee Power co-ops, took over his new duties in Washington early this month.

He has been president of the Middle Tennessee Electric Membership Cooperative, which serves his farm near Murfreesboro, since it was organized in 1935. He also is president and one of the founders of the Tennessee Rural Electric Cooperative Association, statewide organization of power co-ops.

A former teacher and member of the Tennessee Senate, he also has been active in local Farm Bureau and Grange activities.

•

City of North Little Rock Buys Distribution System

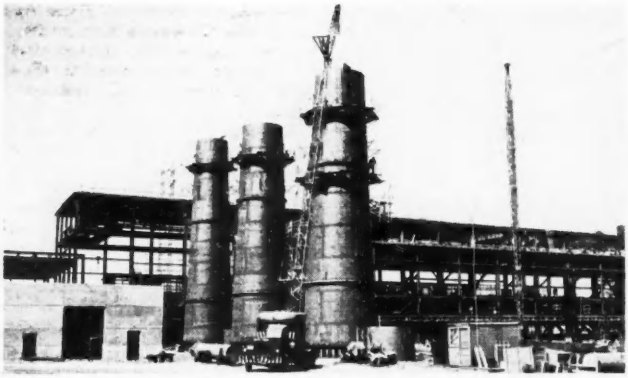
The City of North Little Rock and Arkansas Power & Light Co have reached agreement on purchases by the city of the Rose City power distribution system.

Agreed price was $47,000 plus cost of connections and services to individual customers since July 1. After payment of the purchase price the city will gain an estimated $16,000 in net annual income from the system. Delivery date was set as Sept 15.

•

Texas Utility to Add Unit

Work will begin immediately on a 75,000-kw generator at Texas Electric Service Co's Handley station in Fort Worth. A 45,000-kw unit was completed at Handley in 1948 and another 75,000-kw generator will be added to the utility's system in 1952 as part of a 10-year, $50-million expansion program.



FIRST of three 100,000-kw generators scheduled for installation at the Moss Landing steam plant of Pacific Gas & Electric Co is to go into operation next spring. Rapid progress is being made on construction work. Cost of the complete plant is to be $51.5 million

Excise Tax Collections Vary on Different Items

The electrical industry viewed tax collection figures reported by the government this week with mixed sentiments.

Increased revenues from the energy, light bulb, and refrigerator excise taxes in the fiscal year ended June 30 reflected mounting sales of these items. But the declining tax returns from radio and other appliance manufacturers gave them a potent argument for repeal of the excise taxes.

The Bureau of Internal Revenue report listed actual collections during the fiscal 1949. It showed increased returns on the following manufacturers' excise taxes: $79,347,000 from the 3.3% energy tax, up $9,647,000 over 1948 collections; $26,172,000 on light bulbs, up $1,236,000 over 1948; $77,833,000 from the 10% excise on refrigerators and air conditioning equipment, a $19,360,000 increase.

Revenues from the excise on electric, gas, and oil appliances, unclassified as to type, dropped $6,923,000 below 1948 collections to $80,934,500. Combined returns from the tax on radios and phonographs declined to $49,159,550, or $18,107,000 less than the previous year.

Collections of income, corporation, and all other taxes totaled $40,463,000,000, or about $1,401,000,000 under total collections during fiscal 1948.

•

Louisiana P&L Ups Pay

Louisiana Power & Light Co has raised salaried and hourly employees' wages 7%. Previous wage adjustments were made on the basis of the Bureau of Labor Statistics cost-of-living index, which is lower now than a year ago. The company said the present wage increase was made possible by the close cooperation and coordination of all in the company and by anticipated improvement in future operations.

•

Average Sale Rate Same

In California privately owned and public power utilities sold their energy to ultimate consumers in 1948 at approximately the same price. Statistics obtained from the California Utilities Commission and Edison Electric Institute indicate that the private utilities received an average of 1.59¢ per kwhr. The Public power bodies got 1.61¢.

5 Germans Will Study American Power Plants

Germany is turning to the United States for technical know-how in the field of thermal engineering. The Economic Cooperation Administration is sending five thermal engineers here for a month's study in American methods.

The Germans are interested in learning of American experience gained in the last 15 years concerning:

1. General design of steam power stations, 2. application of material for boilers of high pressure and temperature, 3. operation of cyclone burners using unpulverized small coal, 4. use of superheaters, 5. cleaning of flue gas and utilization of ashes, and 6. standardization of equipment.

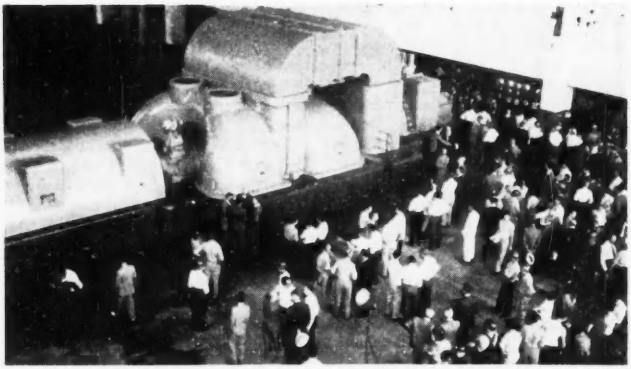
Under the Organization for European Economic Cooperation, Germany hopes to install 3 million kw in capacity by 1952-53.

•

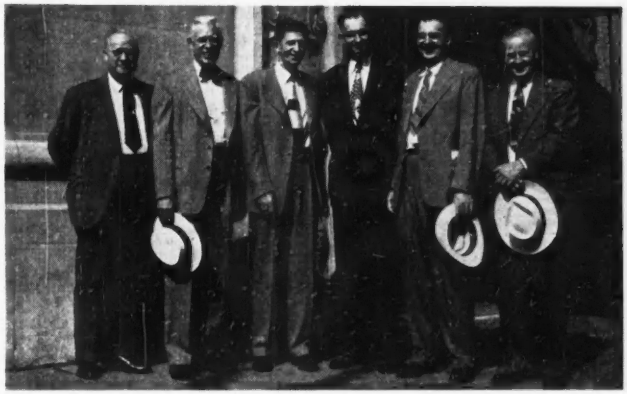
Technical Aid Plan Brings Frenchmen Here to Study

Representatives of France's heavy electrical equipment industry will arrive in the United States this month to begin studies under the first industrial technical assistance project approved by the Economic Cooperation Administration for that country.

The 17-man group, which includes employers, engineers, foremen, and workers, will attend seminars and visit American plants during the six-week visit. Costs will be borne jointly by ECA and the French government. Representatives of other French industries will visit here later in the year.



DETROIT EDISON CO assembles a crowd of company executives, vendors and contractor representatives, and Edison employees to witness the placing of a 100,000-kw unit on the line at the Trenton Channel Plant. The new unit is the largest on the company system



ELEVENTH ANNUAL Client Companies Safety Meeting of Ebasco Services, Inc, will be held in Chicago the week of Oct 24 in conjunction with the National Safety Congress. Sessions are being planned by a six-man committee. Members are, left to right, E. V. Olson, safety director, Washington Water Power Co; W. T. Rogers, Ebasco safety consultant; C. E. Hammon, safety director, Columbus & Southern Ohio Electric Co; H. L. Stewart, safety advisor, Birmingham Electric Co; W. H. Senyard, director of personnel, Louisiana Power & Light Co; and H. R. Pearson, Personnel Department head, Dallas Power & Light Co

Central Vermont Fights for Full Rate Increase

Central Vermont Public Service Corp has appealed to the Vermont Supreme Court from an order of the state Public Service Commission granting approximately 25% of the increased revenues sought. Central Vermont requested rate increases of $337,000 in gross electric revenues. The PSC allowed only $85,000. A satisfactory increase in gas rates was allowed.

Albert A. Cree, Central Vermont president, immediately announced suspension of all rural line construction work not already nearing completion because "it is impossible to see where in the financial market we can turn for adequate capital funds in the face of the Commission's order."

Following a severe flood in 1947, the company suspended dividends. When 326,700 shares of new common stock were issued in 1948, dividends were reinitiated at the rate of 17¢ a quarter. Unless Central Vermont is allowed the entire revenue increase asked, the fourth quarter dividend will have to be dropped. Future dividends will also be reduced. This action would make further financing almost impossible.

•

Okolona May Sell Out

Okolona Farmers Light Co stockholders will meet with representatives of Toledo Edison Co at Napoleon, Ohio, Aug 29 to discuss a purchase offer made by the latter firm. The figure was reported to be about $45,000. Okolona, which operates 47 miles of line serving 184 farmers in four townships, buys energy from the Napoleon municipal plant. Okolona's need for heavier lines to expand service and the heavy cost of line construction are factors in the sale negotiations.

•

Utility Operating Revenues Increase 5.9% in June

Electric operating revenues of the larger privately owned electric utilities in the United States in June 1949 were $352,226,000, compared to $332,605,000 in June 1948, an increase of 5.9%, the Federal Power Commission reports.

Revenue deductions (including operating expenses, depreciation and taxes) were $283,585,000 or 3.1% over those of June 1948.

Gross income, including other utility operating income, amounted to $81,342,000, an increase of 17.9% for the month. Net income was up 21.5% to $59,956,000 from $49,344,000 reported for June 1948.

•

Woman Named to PUC

Mrs Hortense Fuld Kessler, a Newark lawyer, has been appointed to the New Jersey Board of Public Utility Commissioners, the first woman ever to hold the $12,000-a-year post. She is the Democratic minority member.

Missouri Towns Cannot Pass Along Tax Burdens

Residents of cities that impose special taxes on the St. Louis County Water Co must pay for those taxes themselves, the Missouri Public Service Commission has ruled in a far-reaching decision that may increase the rates of most public utilities operating in Missouri cities and towns.

Twenty of the 75 cities, towns, and villages in St. Louis County now collect special taxes from the water company in the form of license or franchise fees. But the tax burdens imposed are distributed equally, in accordance with the volume of water used, among customers in all the cities served.

At the same time the Commission denied the company's application for permission to put a new rate schedule into effect passing part but not all of the cost of the special municipal taxes to the residents of those communities having special taxes. The utility now must file a new schedule varving rates from community to community in accordance with the special tax rates.

The City of St. Louis, which had intervened in the case, has indicated it will contest the Commission ruling as "a dangerous precedent which might well mean an increase in St. Louis utility rates of more than $3 million a year." In general St. Louis charges public utilities 5% of their gross receipts as a license fee. Other cities, towns, and villages are expected to join St. Louis in fighting the decision.

•

New Public Housing Act to Aid Utilities' Business

Utilities, both private and public, serving rural areas are going to get a slight boost in business. It will come when Congress votes the money to back up the new Public Housing Act.

The law has a section authorizing $250 million in loans and $25 million in grants over a four-year period to improve the housing of low income farmers. These are the ones who aren't good enough credit risks to get loans from commercial sources.

Most of the loans will go for improvement of existing homes and farm buildings through such additions as running water and electric wiring. The result will be more rural electric customers, more load, and more appliance sales.

The local agent of the Department of Agriculture's Farmers Home Administration can supply information on the provisions of the new law.

Southern Co Will Move to Georgia After Tax Suit

The way has been cleared for the Southern Co to become a Georgia corporation. It is now incorporated in Delaware. Judge Frank Hooper of Fulton Superior Court has ruled that the company if it domesticates will be exempt from Georgia taxation so far as stocks of its operating subsidiaries outside the state are concerned. The company had filed the suit to obtain a clarification of the laws before moving into the state.

Southern Co has taken over a number of old Commonwealth & Southern companies. These include Georgia Power Co, Savannah River Electric Co, Alabama Power Co, Gulf Power Co, and Mississippi Power Co.

•

25-Year Franchise Voted

Meridian voters have approved a 25-year renewal of the franchise of the Mississippi Power Co. The utility will pay the city annually 2% of retail sales.

SEC RULINGS

Northern States Power Co, Minneapolis, has received authorization to sell at competitive bidding $15 million of first mortgage bonds, Series due Aug 1, 1979. Proceeds from the sale of the bonds will be used to provide part of the new capital required for the 1947-1951 construction program of the company and its subsidiaries. With such proceeds and general funds, including $15 million of bank loans obtained in March, 1949, and due December, 1949, the company expects to be able to carry its program through 1949 and to purchase $1.5 million of the common stock of Northern States Power Co of Wisconsin. (Release No. 9269).

Niagara Hudson Power Corp, Syracuse, N. Y., has received tentative approval of plans to dissolve and to merge its three major subsidiaries. Involved are Buffalo Niagara Electric Corp of Buffalo, Central New York Power Corp of Syracuse, and New York Power & Light Corp of Albany. These utilities would be consolidated into an unnamed new operating corporation, after which Niagara Hudson would be dissolved as a holding company. Final approval, the commission stated, hinges on "minor changes" in the merger proposals and liquidation plans proposed by Niagara Hudson. The principal SEC objection to the company's plan was in connection with distribution of Class A common stock in the new company to holders of Niagara Hudson's new outstanding first and second preferred shares. The utility asked authority to exchange four shares of the new securities for each existing share of preferred. SEC's decision approved such a distribution to holders of the company's first preferred stock, but specified that holders of second preferred be limited to 3.9 shares of the new Class A for each share of the now outstanding issues. Other modifications requested by the commission dealt with so-called protective features in connection with the new Class A stock. SEC approved the following points: (1) Niagara Hudson would receive new Class A and common stock in the new company for the holding company's present common in the three subsidiaries; (2) the new Class A stock would have an annual dividend preference of $1.20 per share. It would be convertible into the new company's common at the rate of one Class A share for 1.1 common shares during the first three years, then at the rate of one for one during the next three years. (3) Common stock in the new company would be distributed on a pro rata basis to holders of Niagara Hudson's new outstanding common. (Release No. 9270).

Potomac Edison Co, Frederick, Md., has received authorization to make additional common stock investments in Potomac Light & Power Co, Martinsburg, W. Va., and South Penn Power Co, Waynesboro, Pa., to finance their construction programs. Potomac Edison plans to purchase 48,000 shares of the no-par common stock of South Penn for $375,000, and 3,750 shares of the $100 par common stock of Potomac Light for $375,000. (Release No. 9271).

MEETINGS

Maryland Utilities Association
Fall Conference, Cavalier Hotel, Virginia Beach, Va., September 9-10.

Instrument Society of America
Clinic on Maintenance of Industrial Instruments, Statler Hotel, St. Louis, Mo., September 9-12; Annual Convention, Municipal Auditorium, St. Louis, September 12-16.

Rocky Mountain Electrical League
Fall Convention, Stanley Hotel, Estes Park, Colo., September 11-14.

Missouri Valley Electric Association
Rural Round-Table, President Hotel, Kansas City, Mo., September 14; Sales and Rural Conference, President Hotel, Kansas City, Mo., September 15-16; Accounting Conference, Robidoux Hotel, St. Joseph, Mo., October 20-21.

Municipal Electric Utilities Association of New York State
Annual Conference, Hotel Murida, Long Beach, L. I., New York, September 14-16.

Public Utilities Association of the Virginias
Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 16-17.

American Chemical Society
National Meeting, Hotel Traymore, Atlantic City, N. J., September 18-23.

Southeastern Electric Exchange
Engineering and Operating Section, Hotel Roanoke, Roanoke, Va., September 19-20; Accounting Section, Henry Grady Hotel, Atlanta, Ga., September 22-23; Personnel Administration Section, Henry Grady Hotel, Atlanta, Ga., September 23; Sales Conference, Biltmore Hotel, Atlanta, October 26-28.

Illuminating Engineering Society
National Technical Conference, French Lick Springs Hotel, French Lick, Ind., September 19-23.

Pennsylvania Electric Association
Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., September 20-21; Prime Movers Committee, Hotel Edison, Sunbury, Pa., October 6-7. Transmission and Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 20-21.

Edison Electric Institute
Accident Prevention Committee, Robert Treat Hotel, Newark, N. J., September 22-23; Electrical Equipment Committee, Hotel Van Curler, Schenectady, N. Y., October 3-5; Meter and Service Committee, Leland Hotel, Springfield, Ill., October 3-5; Transmission and Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., October 31-November 1.
Prime Movers Committee, Sheraton Hotel, Rochester, N. Y., October 10-11.

Wisconsin Utilities Association
Annual Convention, Accounting Section, Dell View Hotel, Lake Delton, Wis., September 22-23; Joint Annual Convention, Electric and Gas Sections, Schroeder Hotel, Milwaukee, Novembr 21-23.

National Electronics Conference
Edgewater Beach Hotel, Chicago, Ill., September 26-28.

★ **American Society of Mechanical Engineers**
Fall Meeting, Lawrence Hotel, Erie, Pa., September 27-30.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., September 28-30.

National Television and Electrical Living Show
Second Annual Show, Sponsored by Chicago Electric Association, Chicago Coliseum, October 1-9.

National Association of Corrosion Engineers
South Central Region, Adolphus Hotel, Dallas, Tex., October 3-4.

Association of Iron and Steel Engineers
Annual Convention (without exposition) William Penn Hotel, Pittsburgh, Pa., October 3-6.

Canadian Electrical Manufacturers Association
Annual Meeting, General Brock Hotel, Niagara Falls, Ont., Canada, October 4-6.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, October 10-11.

American Society for Testing Materials
First Pacific Area National Meeting, Fairmont Hotel, San Francisco, Calif., October 10-14.

American Standards Association
Annual Meeting, Waldorf-Astoria Hotel, New York, October 11-15.

International Association of Electrical Leagues
Annual Conference, Hotel Cleveland, Cleveland, Ohio, October 12-15.

Electrochemical Society
Fall Congress, La Salle Hotel, Chicago, Ill., October 12-15.

American Institute of Electrical Engineers
Midwest General Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, October 17-21.

American Welding Society
Annual Meeting, Hotel Cleveland, Cleveland, Ohio, October 17-21.

National Safety Council
National Safety Congress and Exposition, Stevens, Congress, Morrison, Sherman Hotels and the Palmer House, Chicago, Ill., October 24-28.
★ Electrical Equipment Section, Stevens Hotel, October 26-27.

National Metal Trades Association
Annual Convention, Palmer House, Chicago, October 26-28.

National Electrical Contractors Association
Annual Convention, Rice Hotel, Houston, Tex., November 8-11.

National Electrical Manufacturers Association
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

Refrigeration Equipment Manufacturers Association
All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City Auditorium, Atlantic City, N. J., November 14-18.

★ Additions this week

Output Moves Upward; Shows 3.5% Increase

The amount of electrical energy distributed by the light and power companies amounted to 5,578,800,000 kwhr for the week ended Aug 20, 1949, according to figures released by the Edison Electric Institute.

This total compares with 5,390,788,000 kwhr for the corresponding week of 1948, this year's figure representing an increase of 3.5%. The percent change from the previous year amounted to a plus 4.0 for the week ended Aug 13.

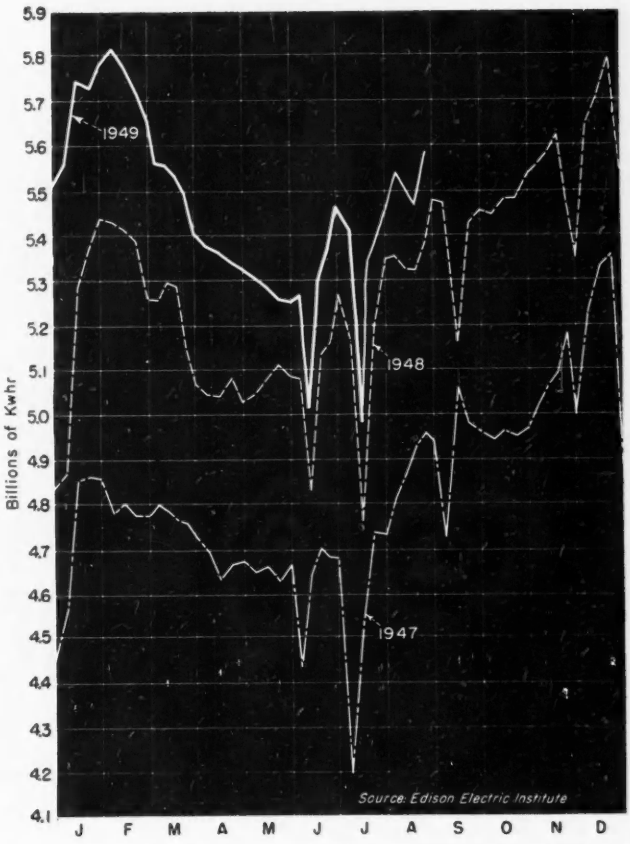
Two of the geographical regions reported decreases, the Mid-Atlantic and the Central Industrial, with drops of 1.9% and 1.1% respectively for the week ended Aug 20. During the preceding week the Mid-Atlantic group had entered the plus columns.

Weekly Output, Millions Kwhr

1949	1948	1947
Aug. 20 5,579	Aug. 21 5,391	Aug. 23 4,953
Aug. 13 5,530	Aug. 14 5,318	Aug. 16 4,923
Aug. 6 5,466	Aug. 7 5,319	Aug. 9 4,874
July 30 5,518	July 31 5,352	Aug. 2 4,806
July 23 5,462	July 24 5,342	July 26 4,730
July 16 5,342	July 17 5,197	July 19 4,732
July 9 4,982	July 10 4,760	July 12 4,531
July 2 5,410	July 3 5,166	July 5 4,190
June 25 5,466	June 26 5,257	June 28 4,675
June 18 5,373	June 19 5,159	June 21 4,676
June 11 5,300	June 12 5,132	June 14 4,702
June 4 5,018	June 5 4,845	June 7 4,635

Percent Change from Previous Year

	Aug. 20	Aug. 13	Aug. 6
New England	+ 2.4	+ 5.3	+ 4.0
Mid-Atlantic	— 1.9	+ 1.4	— 1.6
Central Industrial	— 1.1	— 0.1	— 1.7
West Central	+ 6.2	+ 6.9	+ 3.2
Southeast	+ 5.9	+ 5.8	+ 6.3
South Central	+11.3	+ 3.7	+ 5.3
Rocky Mountain	+14.7	+13.3	+11.9
Pacific Coast	+ 8.2	+ 8.1	+ 7.6
Total United States	+ 3.5	+ 4.0	+ 2.8



2 Records Set by Utilities in Canada in 1st Half of '49

Canadian utilities are out of the woods and on the way to the greatest production year in their history. For the first half of 1949 they set two records. First they produced 23,462,350,000 kwhr. Second, primary consumption reached 20,706,990,000 kwhr.

In June output topped 4 billion kwhr for the third month. The total was 4,018,065,000 kwhr. Primary consumption was 3,481,039,000 kwhr.

For the Canadian utilities these figures are most significant. A long drought is over and the effects of new capacity are being felt. In the past 35 months primary consumption has exceeded that of the same month a year previous with one exception, February, 1949. This indicates a growing demand for electricity that the utilities are now able to supply. It also indicates that in the future there will be available for industry a larger amount of secondary power. Some six months ago the chemical and paper industries, which use most of the secondary power, were unable to obtain it because of primary demand.

Exports to the United States are still lagging, though they are ahead of 1948, when exports fell to the lowest in a decade.

The following statistics supplied by the Dominion Bureau of Statistics are in thousands of kilowatt hours:

Period	1949	1948
Six months	23,462,350	22,528,614
Primary	21,396,649	20,805,743
Secondary	2,065,701	1,717,872
Primary Consumption	20,706,990	20,139,660
Net Exports to U. S.	933,291	871,936
June	4,018,065	3,717,619
Primary	3,793,215	3,499,655
Secondary	419,820	267,964
Primary Consumption	3,481,039	3,350,957
Net Exports to U. S.	134,607	169,890
May	4,271,027	4,072,923
Primary	4,004,177	3,876,826
Secondary	566,850	196,147
Primary Consumption	3,587,723	3,454,903
Net Exports to U. S.	181,960	184,781

Co-op in Virginia Offers to Sell Part of Facilities

Shenandoah Valley Electric Co-operative has decided to offer part of its facilities at a selling price of about $1 million to the Old Dominion Electric Cooperative, made up of 11 Virginia co-ops.

The property to be offered includes a 2,940-kva internal combustion generating plant at Dayton, substations, and high-voltage transmission lines. The sale, General Manager L. E. Long estimated, would reduce the co-op's bonded indebtedness to the federal government by about $1 million and mean an annual saving of between $50,000 and $60,000.

Shenandoah Valley also plans merger with a statewide electric cooperative association to be formed to utilize cheap power from the federal Buggs Island and Roanoke River developments.

WASHINGTON COMMENT

WILLIAM B. WHICHARD

THE PROSPECTIVE investigation of lobbying represents an effort by Congress to cope with one phase of the many and tremendous pressures to which its members are subject. Fortunately, the probers seem disposed to tackle all kinds of lobbies—those representing government agencies and programs, labor and other groups, as well as business interests.

Considerable doubt remains, however, regardless of the findings of the investigators, as to what Congress can do about lobbies. It will not outlaw them entirely. Few, if any, Congressmen want that. The only alternative appears to be further regulation beyond that provided by the present Lobby Registration Act.

But Congressional irritation with lobbying is only a token protest against pressures of all types. Every member of Congress is subject to these pressures. They come from his party leadership, from friends back home and in Congress, from constituents, and from strangers. Then there are the pressures of time and circumstances. Appropriations bills and other vital legislation must be acted upon at each session. And, except under very unusual conditions, compromises must be worked out in the process of adopting most major bills. During the latter process, even the most able and intelligent of Congressmen may be forced to give up five objectives in a bill to get one other enacted.

Such considerations effect the shaping of national policies far more than lobbyists. On federal power policy, for example, the pressures of time and legislative circumstances often have decided vital issues. Take the cases of Senator X and Congressman Y.

Senator X, an able first-termer, comes from an area where the public-vs-private power battle waxes as hot as in any section of the country. But the Senator has never been identified with partisans of either side. He opposes federal intervention in the power industry on what he terms a "major scale." But he favors plans of the Interior Department to build transmission lines—all of them outside his state, incidentally—on the grounds that a "little competition is good for the power industry."

In fairness to the Senator, it should be reported that he is seriously concerned with other, perhaps more important, legislation. Otherwise, he might have both the time and inclination to study the development of federal power, which already is giving the industry more than a "little" competition.

Congressman Y, on the other hand, is a veteran who should know better. He recently voted in committee for authorization of a huge, extremely expensive federal hydro development. At the time he admitted to grave doubts as to the enginering and economic feasibility of the project. But, he added, the Committee would not approve—or even consider—other, definitely worthwhile projects without the dubious development.

Obviously, no lobbyist, or anyone else, has been able to convince Senator X, Congressman Y, and a good number of their colleagues that it is essential to limit federal power operations at some point or other. Until that job is done, the industry will continue to lose legislative battles to the combined pressure of time, legislative circumstances, and anti-utility lobbies.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Titanium has a high strength-to-weight ratio, good resistance to corrosion and should become competitive with light alloys if it can ever be detached economically from the ore oxygen to which it clings with titanic force.

Surface leakage and high quality of insulation constitute the crux of decisions to omit lead sheaths from cables or achieve a substitute.

Instruments for measurement of high-frequency voltage are fewer by far than those available for current measurements and there are hardly any for direct measurement of impedances. Both are needed for intelligent carrier application.

Coaxial cable over a 650-mile stretch in Texas is being monitored by an alarm system which indicates blown fuses, improper battery charging, power failure or gasoline reserve failure—among 160 other possible trouble conditions.

Neon glow lamps are now being given life ratings up to 25,000 hours. Small ones take only 1/25 w.

Voltage can be regulated from one phase of a 3-ph system in a superior way for all three phase if neutral compensators are used to override the voltage unbalance.

Impulse strength uncertainty is one factor that makes for some reluctance to use non-metallic sheathed cable for generator leads. Reluctance regarding secondary mains has waned.

Low-loss coaxial cables have made carrier installations much more flexible because they permit placing the transmitter near cognate equipment rather than close to coupling capacitor as has usually been necessary.

Characteristic impedance of 65 to 70 ohms is commonly chosen for coaxial cable in carrier applications. This best approximates the value for typical networks and thereby minimizes loss and distortion.

FORECAST FOR FIFTY

Rising production, high employment and continuing good general business are in prospect for the second half of 1949 followed by a year of normal prosperity and growth in 1950 Utilities will be adding plant at about the current rate

ALL BUSINESS SIGNS for the remainder of this year and for next year indicate stability in the electrical industry. The need for continued expansion of electric facilities in 1950 at a rate just slightly under 1949 is forecast in this mid-year review.

As it looks now, late 1949 will see production gain about 10%. The physical volume of retail sales will be up slightly, prices will continue to decline slowly, and wage rates will rise.

In 1950 business as a whole has in prospect a year of normal prosperity and marked growth—if industry can continue effectively to increase productivity and cut its costs, giving customers attractive products at attractive prices. So far this year business has done an outstanding job along these lines.

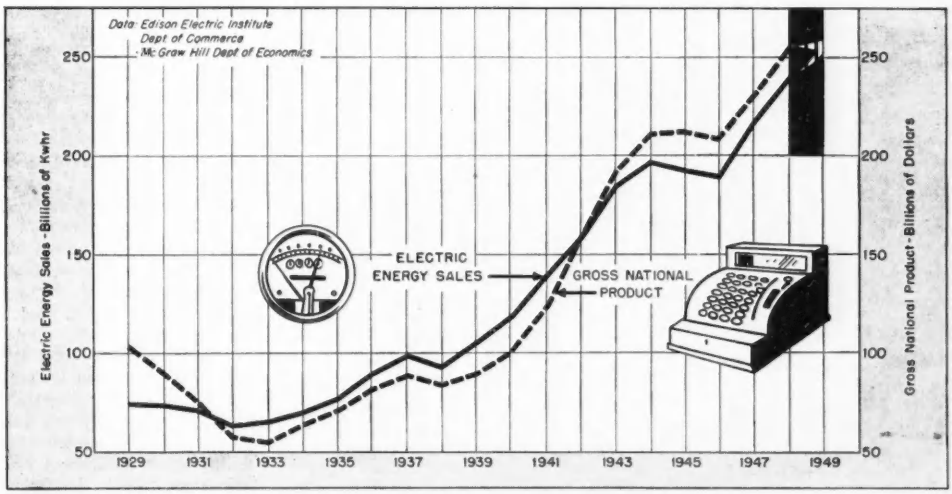
Electric utilities weathered the cutbacks in general business in early 1949 with the help of steady increases in residential and commercial sales. Overall, the industry produced 5.6% more energy in the first half of 1949 than in the comparable period of 1948.

By year's end industrial power sales should be running equal to last year—and 15% above the current level as industry recovers from the first-half slump in production. This poses the danger that some power companies may underestimate their year-end position because industrial demand will grow faster than they expect. Residential, rural and commercial sales should hold above last year at about their current margin. By December total electric power sales may well be running 10% above last year.

Earlier predictions of a 9% growth in peak would seem to be practically assured. Perhaps the corresponding forecast of 8.3% gain in production will not be reached due to lower sales in the first half of 1949.

With normal prosperity expected in 1950, power prospects are bright. A gain of 10% over 1949 is clearly possible. High consumer incomes, near-record homebuilding, and appliance sales at a high-level fore-

General business activity dips, while electric power sales rise



Gross national product—the total value of all business done in the nation—dropped 4% from the end of 1948 to the middle of 1949

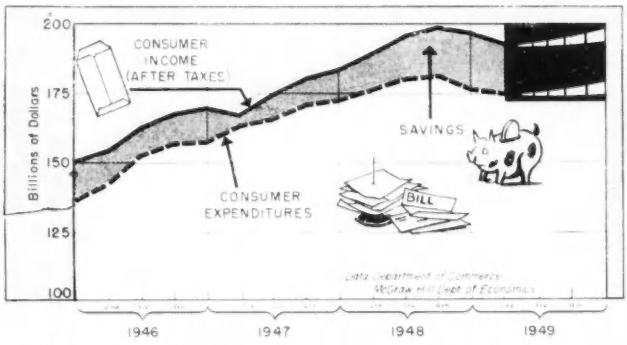
Power production continued to rise, but gains over the previous year narrowed steadily until July when the trend changed

shadow a continued yearly residential gain of around 14%. Industry's drive for greater efficiency will require greater use of power. Thus, industrial power sales may rise 10% to 15%. Rural and commercial sales should continue to move ahead as they have in 1948 and 1949.

The industry's May 1949 prediction of a 7% gain in peak load and a 6.3% increase in production of energy for 1950 seems to be well on the conservative side. Capital expenditures will still be substantially related to generating capacity additions amounting to 10% of total now installed, or some 6 million kw.

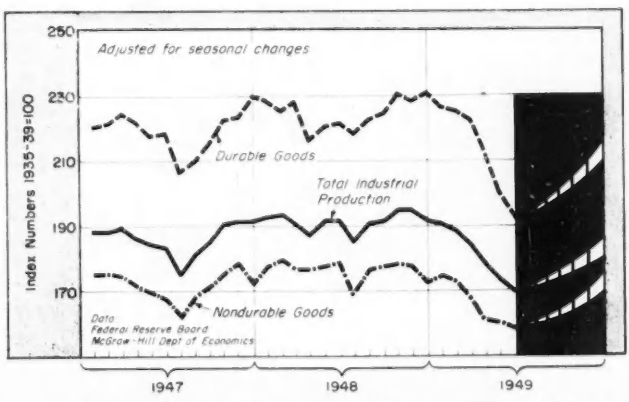
Recovery from the "inventory slump" early this year makes prospects bright for electrical manufacturing too. By year's end appliance sales should match last year's physical volume, though prices will be lower. Next year's sales can run another 5% to 10% higher—if manufacturers and dealers offer good values to customers and sell hard. With continued high level utility capital expenditures assured by the upward trend in power sales, production of heavy electrical equipment will stay high. The ratio between generating and distribution expenditures will not vary widely from 1949.

People's incomes dip slightly



Personal incomes have fallen only 3% since December and are still well above a year ago. Thus, people have plenty of purchasing power. But for the past year, they have been saving more, spending more carefully. Stability in prices should reverse the trend

Industrial production drops 13%



Manufacturing and mining output fell three times as far as general business activity. The reason: business was working off inventories. As usual, durable goods production dropped more than nondurables but durables will climb faster in the next six months

1949 Construction and Inventories

An ELECTRICAL WORLD survey of major electric companies reflects the industry's confidence in its position. On the whole, the industry is going ahead with its plant and equipment program for 1949 just about as it was planned. Power companies and municipal utilities are carrying through almost on schedule the capital expenditures of $2,365,340,000 forecast early in the year. Companies in the East Central area, where there is currently no power shortage, have cut back their budgets moderately. Others have seen their first-half programs set back because of weather or delays in construction or delivery of equipment. Offsetting these are substantial increases recorded by companies in other sections so that, on balance, the industry promises to carry out its 1949 plans. Helping along the 1949 program is the fact that the industry has been successful in its financing program. Earnings have held up well and, in all, utility companies raised $880 million in new money during the first six months.

Private companies have also maintained inventories of equipment and supplies at a high level. Their inventories, exclusive of fuel, rose steadily through April and then began to drop moderately. By June they were 4% under the April peak, but still 2% over a year ago. This is a normal seasonal drop due to the high rate of withdrawals for construction purposes. The shift does mark a change in purchasing policies, but for most companies it meant only that purchasing agents were limiting orders to current requirements and were not trying to cut back stocks drastically.

A few companies, however, are trying to bring their inventories down.

The marked variations in general business in different regions that developed this year are likely to continue—but they may not be as great. New England, for example, was hard hit by cutbacks in manufacturing.

The business outlook can be put into a nutshell this way: Business can look for rising activity through 1949 and for normal prosperity in 1950; utilities must continue to expand their capacity—at about the same rate as in 1949—to meet the demands of a growing economy.

Business Prospects for the Rest of 1949

WHAT HAS HAPPENED to business so far in 1949 is clear: Business has been in an "inventory slump." Once prices turned down—as they began to on a broad front early this year—businessmen, with one of those unpredictable and rare displays of unanimity, stopped buying wherever they could. New orders to manufacturers dropped—and they cut back production. The Federal Reserve Board's index of industrial production dropped 13% by June. Electrical manufacturing shared in the decline. *American Machinist's* index shows a 15% drop in electrical manufacturing between June, 1948 and June 1949.

Why did the inventory readjustment bring such a quick cut in production and employment? The answer is that a small change in inventory needs of retail stores is quickly magnified into a big change in manufacturers' orders. If a retailer is already well stocked, and his business falls off 5%, he may cut his orders to manufacturers by say 15%. They in turn, may cut orders to the suppliers by 30%—or more. The process snowballs into a sharp cut in production of basic materials.

The inventory slump hit electrical manufacturing early and hard. Sales of appliance stores dropped more than 40% between last December and February 1949. Part of decline was seasonal, of course. May sales in dollars were only 5% below last year. Nevertheless, retailers set out to get rid of inventory, and cut their orders to manufacturers sharply. Manufacturers, in turn, cut their own inventories 5% in April and May, according to latest Commerce Department figures. Bigger cuts have undoubtedly been made since then.

In the meantime—while businesses were working off inventories—people continued to buy as much at retail as they had during 1948. The overall dollar volume of retail sales has been virtually on a plateau since early 1948. Because prices are lower, this means that the actual physical volume of goods moved into the hands of consumers is greater now than it was a year ago.

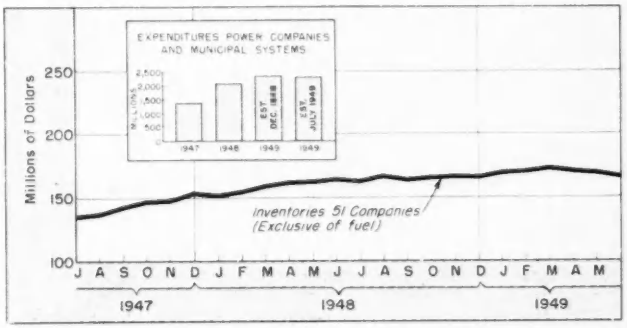
New Buying Forecast

This lays the groundwork for a pick up in production and employment by early fall. Retailers will be forced to start buying again to restock their shelves. And, just as a cut in their orders brought successively bigger cuts in manufacturers' and raw materials producers' order, the revival in retail orders will generate a real pick up throughout the business structure.

There is, of course, one other unpleasant possibility. It is that unemployment, created largely by the chopping off of orders in the first half of the year, will give people a severe case of the jitters. However, it does not seem likely to happen. For one thing, the American people are exceptionally well-heeled.

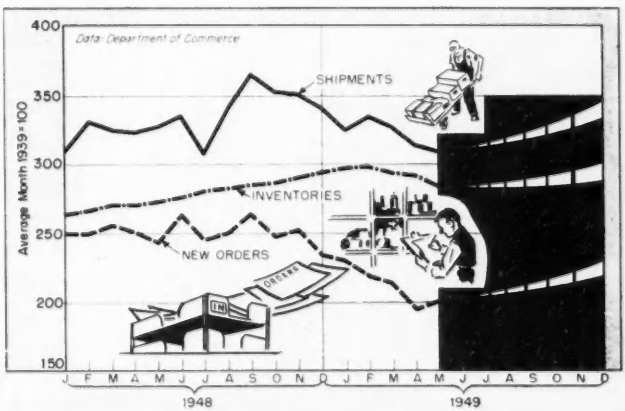
A recent report by the Federal Reserve Board on a nation-wide study of consumer finances shows that con-

Utility inventories and construction program


EXPENDITURES POWER COMPANIES AND MUNICIPAL SYSTEMS
Millions of Dollars
250
200
150
100
Inventories 51 Companies (Exclusive of fuel)
J A S O N D J F M A M J J A S O N D J F M A M
1947
1948
1949

Substantially all of the planned construction for 1949 will be completed by utilities, according to recent survey. Inventories are being cut moderately after reaching all-time peak

Manufacturers' orders drop more than sales



As orders from retailers skidded early this year, manufacturers piled up inventories. But they cut down their buying and worked off inventories in April and May

sumers are better off financially than they were a year ago. Incomes in 1948 rose sharply to new record levels and seven out of every ten families had something set aside in government bonds or bank accounts.

For consumer jitters to spread, unemployment would need to rise rapidly in the next few months. But there are impressive elements of strength in key areas of our economy that should prevent any rapid rise in unemployment. Here are a few of them:

1. Construction as a whole is moving to new records. Public works—highways, schools, and the like—are running about 25% ahead of a year ago. Home building is running better than expected. More new homes—100,000—were started in June than a year ago. Prospects are that 1949 will see almost as many homes completed as last year's record total, though the average 1949 home will be somewhat smaller. Thus, the demand for appliances, and for electric power, will rise in the next few months.

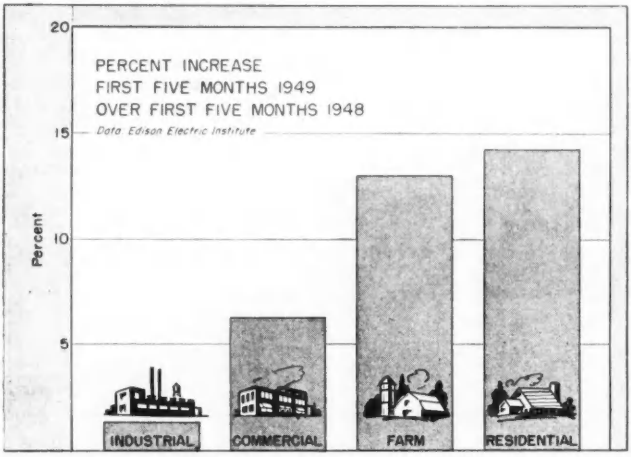
2. Capital goods production—tools and equipment for industry—is expected to stabilize where it is today, or perhaps pick up slightly. Industry's plans to buy new plants and equipment in the third quarter are down only 4% from the second quarter.

3. Government deficit spending will increase during the rest of 1949, providing a mild boost to business. And the Federal Reserve Board will do all it can to loosen bank credit.

4. Exports promise to hold at their recent high level—around a billion dollars a month—despite British restrictions on dollar imports.

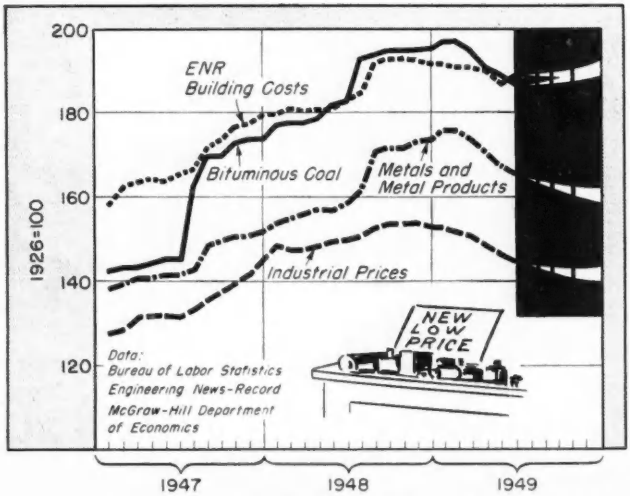
5. Farm income is expected to be off only about 10% from last year's record total. Though prices are lower, the quantity of farm production will be higher than last year.

Residential sales lead the field



For the first five months of 1949 residential use gained at the same rate as last year. Commercial and Industrial designations on the chart are the same as the small and large light and power classifications as reported by Edison Electric Institute

Prices turned down as demand fell



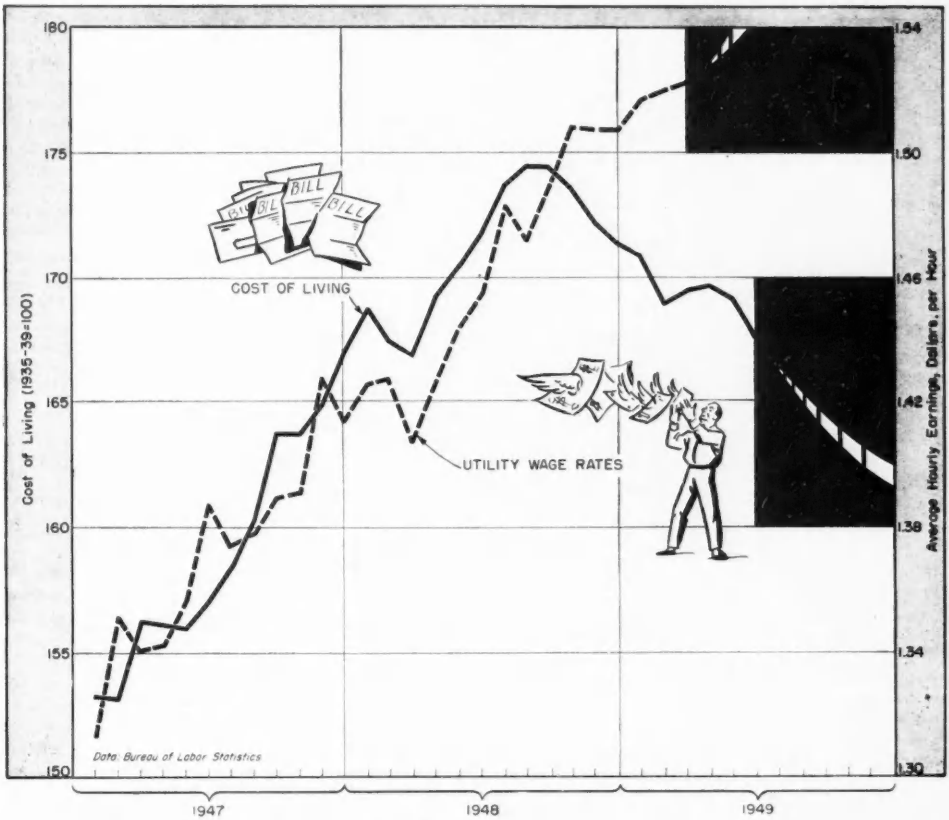
Once production caught up, prices fell. Industrial prices are off 8% since last August

Buying Will Continue

With business bolstered in these ways, there is no significant rise in unemployment in sight in the next few months. People will probably continue to buy about the same volume of goods and services they have been buying for the past 18 months. The result: Retailers and manufacturers, who have been living on their inventories, will be forced to begin buying again.

What a pick-up in orders can mean for business is shown by one fact: Inventory liquidation has been great enough to account for about 18 points of the 26-point drop in the Federal Reserve index of production. The index dropped from 195 last November to 169 in June. A turn in the inventory situation probably will not carry the index back to 195. But normal business during the last quarter may well lift industrial production to 180-185 on the Federal Reserve index.

Wages rise, living costs fall



Living costs are off 4% from their postwar peak, while utility workers' wages have risen 10% in the past year. Utility wages are 82% above prewar while living costs are up 69%. Recent wage increases indicate an even more favorable relationship between wages and cost of living

All this suggests that 1949, when the record is in, will compare very favorably with 1948—and 1948 was not a normal year. Rather, it was the last year of the postwar boom.

The first stage of the postwar era was an expanding process. People wanted more of almost everything than they had at the end of the war. Businessmen tried to gear up to meet these demands, by building up inventories and expanding their plans.

In the resulting boom, prices, employment, and production rose to levels that could not be sustained. By the end of 1948, the boom began to fray at the edges.

The appliance market is well into the second stage of the postwar era. The backlog for additional refrigerators, washers, and other appliances has been filled. Future sales will depend on (1) the annual growth in the number of families (about 1,300,000 in the past year) and (2) the success of the industry in selling new appliances to people who already have old units.

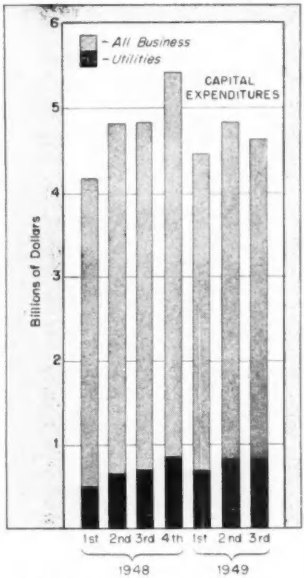
Tremendous Backlog Gone

The department of Commerce estimated that there was a backlog of demand at the end of the war for about 5 million washers, 7 million refrigerators, and 5 million vacuum cleaners. To meet this demand, appliance makers geared up for record output. Washer and vacuum cleaner production in 1948 was double the highest prewar figure while refrigerator output was 50% above any previous year. As a result, backlogs have disappeared.

Clearly, appliance makers must go to selling with a vengeance. To keep production near its record 1948 level, they must turn out new and better products at prices that will tempt customers to turn in their old appliances for new ones. Companies have made notable progress so far. Television has more than filled the gap left by the drop in radio sales. Automatic washers now make up more than a fifth of unit sales and a considerably higher proportion of dollar washer sales.

The fact that business had done so well on the selling front is the chief reason why we expect business ac-

Capital investment holds firm



Business investment in new plants and equipment is running within 5% of last year's record program. Utility investment is 20% ahead

tivity to pick up in September and October and to move on through 1949 at a normal prosperity level. But, in many ways, normal prosperity will differ greatly from the boom conditions of 1947-48. Production will be somewhat lower because there will be less pressure to build up inventories and because the pressure will be on price and quality, instead of on quantity. Competition will get increasingly tough, so many prices will decline and many industries will find the going increasingly tough.

But businesses that can turn out attractive products, and sell them aggressively at attractive prices, will prosper.

Here is how we expect some of the leading business indictors to look at the end of 1949:

1. Industrial production, as measured by the Federal Reserve Board index, is likely to stand at 180-185, as against the June figure of 169. Electrical manufacturing activity, as measured by the *American Machinist* index, should rise about 10% from the June figure of 191.

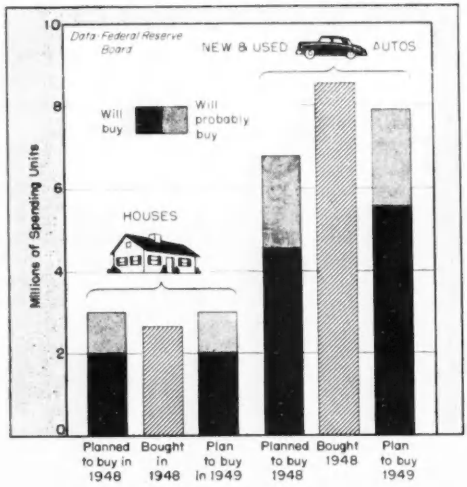
2. The physical volume of retail sales will be up slightly from today's level. Electric appliance sales should come close to last year's record level.

3. On the average prices will be lower, probably by a few percentage points. But many prices, notably those like copper, which have already undergone a substantial amount of "disinflation," will be moderately higher than they are today. In some cases, labor unions will play a major role in setting price trends. Steel and coal prices, for example, will probably be held at their present levels, chiefly because of union action.

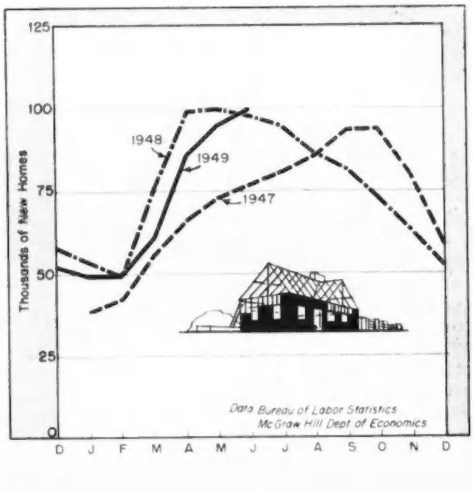
4. As this is written—while the President's steel "fact-finding" board is beginning its investigation—the best estimate of the wage outlook is that big unions in the mass production industries like steel and autos will succeed in getting increases of five to ten cents an hour. But many companies will settle with no increase in wage rates. However, even with the same wages, workers will receive about a 5% increase in living standards because of lower prices.

5. Construction bids—already off 20%–25% from last year's peak—are not likely to go much lower. In fact, there is a possibility that it will cost slightly more to build late in the year than it does now.

Demand strong for new cars and homes



Housing starts pass last year's mark



A Federal Reserve survey early this year showed that people planned to buy at least as big a volume of new homes, cars, and other durable goods this year as last. Thus, markets are still strong—for goods that are attractive and attractively priced. Homebuilding picked up smartly after March and starts were actually larger this June than in June, 1948. Reduced construction costs will help sustain activity

The Business Outlook for 1950

WHICH WAY will business go in 1950? Much can happen in the next 18 months to change the course of business, of course. But barring war (or some other major international upset) the prospects are that business will roll on at prosperity levels through 1950. For electric power sales, the prospect is for a 10–12% gain over 1949. For electrical manufacturing, an increase of 5–10% during 1950 in production and sales is in prospect if companies continue to sell effectively.

The most important reason why 1950 should be a year of prosperity is that the 1949 inventory slump brought most prices and costs down enough to keep sales at a high level. Prices in general went down far enough to enable business to tap the huge replacement market.

This backlog of replacement needs provides a market big enough to ensure several years of prosperity, if business is permitted to tackle the job, and tackles it effectively. Up to now, business has been doing a fine job.

A second reason for believing that 1950 will be a good year and that business can successfully meet the demand for better goods and lower prices is this: The stage is set for a substantial increase in productivity (output per man-hour). Rising productivity will make it possible for business to cut prices and still earn enough profit to finance capital investment needs.

During 1949 business shifted emphasis in its program of buying new plants and equipment from expansion to modernization. That shift should begin to bear fruit in 1950. The resulting rise in productivity may match that in the three years after World War I. Then, productivity in manufacturing industries rose 10% each year. A 10% rise in manufacturing productivity in 1950—which is a distinct possibility—would go far in laying the groundwork for an extended period of prosperity. It would permit lower prices and thereby raise everyone's living standard. It would broaden markets enough to maintain full employment.

Are there any broad areas of weakness in the economy that promise serious trouble for 1950?

The best way to explore this question is to look at the major divisions of the nation's economic budget. Here is how they lined up in the last half of 1949: (figures in billions of dollars at seasonally adjusted annual rates)

	1948 2nd Half	1949 1st Half
Consumer purchases	180.6	175.8
Durable goods	23.3	21.8
Nondurable goods	104.7	100.2
Services	52.6	53.8
Business investment	42.8	35.7
Housing	7.3	6.3
Other construction	8.9	8.2
Productive equipment	22.3	21.8
Change in inventories	4.4	0.6
Net Private Foreign Investment	0.5	0.6
Government purchases of goods and services	38.8	41.8
Gross National Product *	$262.7	$253.9

*Gross National Product is the broadest measure of business activity because it adds up the sales of all U. S. businesses.

The consumer market should remain strong throughout 1950—if business can continue to do a real selling job. Consumers still have a big backlog of needs for better quality products. They demonstrated in 1949 that they will buy avidly goods that are priced right.

Consumer demand is still bolstered by huge wartime savings. At last count (1948) people still had $175 billion in cash, bank deposits and government bonds. And savings are still broadly distributed. A Federal Reserve survey showed that 43% of all families have $500 or more saved up.

Appliance Sales

Last year people spent about $5 billion for all types of appliances. This year's figure will be less, by about 5%. There is a potential market next year which is 10–15% greater than 1949 sales. Rising consumer incomes plus the savings backlog suggest that. However, this potential can be reached only if people find better values in appliances than in other durable goods like autos and furniture.

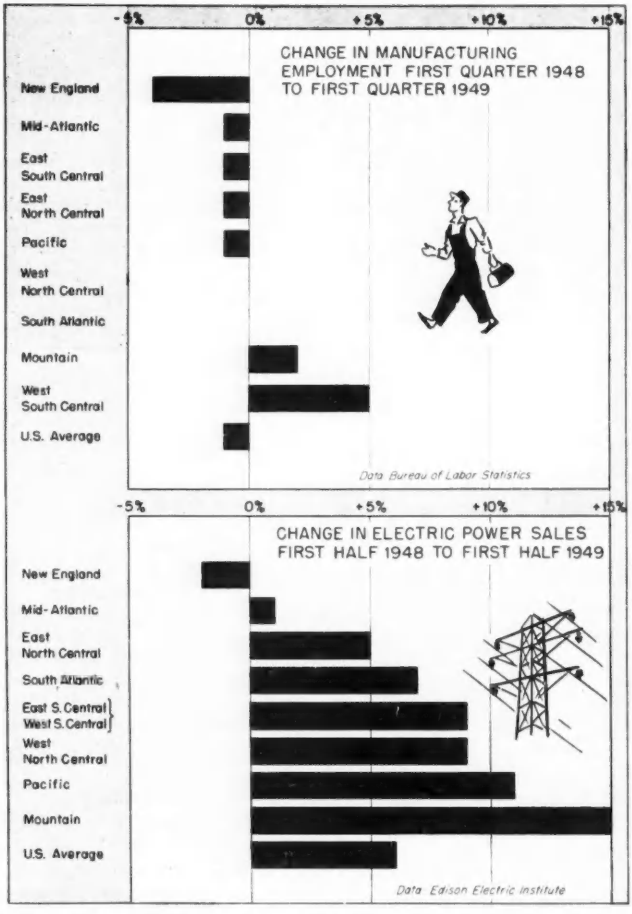
Consumer demand will also receive a sizable boost from payment of a $2.8 billion dividend on veterans' insurance in the early months of 1950. Experience suggests that a major share of the money will be spent for durable goods and housing. If two-thirds of the money goes into these channels, demand will be 7%–8% higher than in early 1949.

The decline in construction costs during 1949 laid the ground work for a rising volume of construction in 1950. In many cases the actual price of new construction to the buyer is now 20%–25% lower than it was during 1948. Most construction cost indexes show a much smaller drop because they are based on material prices and wage rates. But higher productivity and lower contractor margins have reduced actual costs much more than published indexes show. This cut in costs will open up new markets, particularly in the housing field. Moreover, construction costs will probably stabilize soon, and may move slightly higher during 1950.

Continued Business Expansion

Business will not have firm plans for capital expenditures in 1950 for several months. But there are already some signs that business may invest as much, and may possibly invest more, than this year. The return of intense competition reinforces the need for cost-cutting equipment. Moreover, business will do fairly well profit-wise in 1949—so it should be able to raise the money it needs to keep equipment purchases at a high level. Profits declined 25% between 1948 and the second quarter of 1949. But, for business as a whole, this is largely explained by the fact that many companies which had been making money on inventories lost money on them this year. The drop in copper prices, for instance, hit electrical manufacturing hard. With inventories stabilized or rising slightly in 1950, business profits will look better than they do now. If the

How business varies in different regions



Number of workers in manufacturing industries falls in most areas—but the area around Texas and the Mountain States shows gain over last year. Power production—which reflects activity in business as well as construction and consumer use—gains in all areas except New England

improvement in profits stimulates the flow of equity capital, business investment may be higher in 1950 than it is this year. If not, business will still be able to raise enough money—by ploughing back profits—to keep capital investment close to this year's figure.

The outlook for exports is less encouraging. So far, in 1948, U. S. exports have been moving at a rate of $1.1 billion a month. But foreign countries -- notably Britain — have been using up their gold and dollar reserves. Moreover, U. S. aid, in the form of ERP and other forms of assistance, will probably decline by $2 billion in the coming year. As a result, a decline in exports of 20% or so is expected next year. But this decline should not have serious consequences for the economy as a whole. Most of the decline will be in food exports. Heavy goods exports, including electrical machinery, should increase.

Government can be expected to spend more next year. Despite the strongest pressure for economy in 15 years or more, federal, state and local governments may well spend $3–4 billion more in 1950.

Review of 1950

This brief review of the major sectors of the nation's economic budget shows why present prospects are for continued prosperity. In every area except exports, the outlook is favorable. If all these economic trends move in the direction they are now headed, 1950 will be a year of normal full employment and expanding production.

With normal prosperity during 1950, here is how leading business indicators can be expected to stand at the end of the year:

1. Industrial production, as measured by the Federal Reserve index, may well be in the 195–200 range. Increasing productivity and the normal increase in the labor force can raise industrial production by about 10% from the level expected for the end of 1949.

2. Gross National Product—the nation's total output of goods and services—promises to reach a level of about $260 billion, 4% higher than it is now.

3. Unemployment probably will stay at about 3.5 to 4 million.

4. Prices will be slightly lower, largely because of a further decline in farm and food prices. Construction costs are likely to be higher—perhaps about 5%—as increased building activity pushes building materials output to capacity. In the areas dominated by big unions, wage rates will probably rise again, putting pressure on prices. However, in most cases, competition will prevent business from raising prices. For example, competition from petroleum and natural gas will make it hard for coal operators to up prices.

5. Output in some of the major power-consuming industries will rise by more than the average for all industrial production. The steel operating rate is likely to hover around 90%. Chemicals production may well go up by 25%. Non-ferrous metals production, which has dropped about a third in the past year, can be expected to recover its lost ground.

6. Homebuilding can expect another big year with 850,000 to 900,000 new starts. This will add to the market for appliances, furniture, and for electric power.

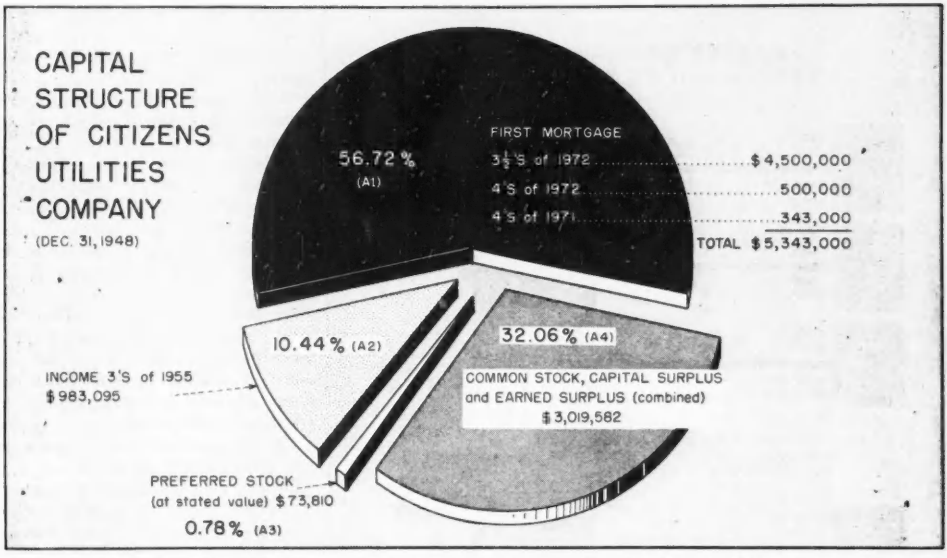


CHART 1—CAPITAL STRUCTURE of Citizens Utilities Company as shown for the end of December 1948 is considered conservative

A Pragmatic Approach To Reasonable Rate of Return

A rate of return on capital as measured by the standards of the cold, bloodless verdict of the market place is held to be the only sound basis for attracting investors

RICHARD L. ROSENTHAL
President
Citizens Utilities Company
Greenwich, Conn.

THROUGHOUT THE HISTORY of public utility regulation by state and federal commissions, the essential question has always been: What is a "fair" or "reasonable" rate of return. And the state commissions and even the courts have, by and large, always answered the question by, in effect, saying: *In our opinion*, a "fair" *or* "reasonable" or "fair" *and* "reasonable" rate of return is some elusive percent, arrived at, by and large, in a seemingly esoteric and certainly subjective way.

In recent years and with particular reference to the Hope Natural Gas case decided by the Supreme Court, Commission decisions and law built up in the courts have *legally* developed the definition of "reasonable" rate of return as one which would provide sufficient earnings to enable a utility company to:

1. Service its present capital obligations.

2. Provide an "adequate" return to its equity owners.

3. Attract new capital into the business, in order to furnish the utility company with the funds to continue to expand facilities and/or replace obsolete equipment and thus adequately serve its consumers.

Stated another way, this recent concept of "reasonable" or "fair" rate of return has, in some state jurisdictions and particularly in the courts, taken cognizance of the realistic fact that a utility company must have sufficient earnings to attract new capital into the business. It recognizes that if this is not the case, there will be impairment of the ability of the utility to finance expansion and improvement of its property and plant; and equal impairment of the ability of the utility to take advantage of advances in equipment design.

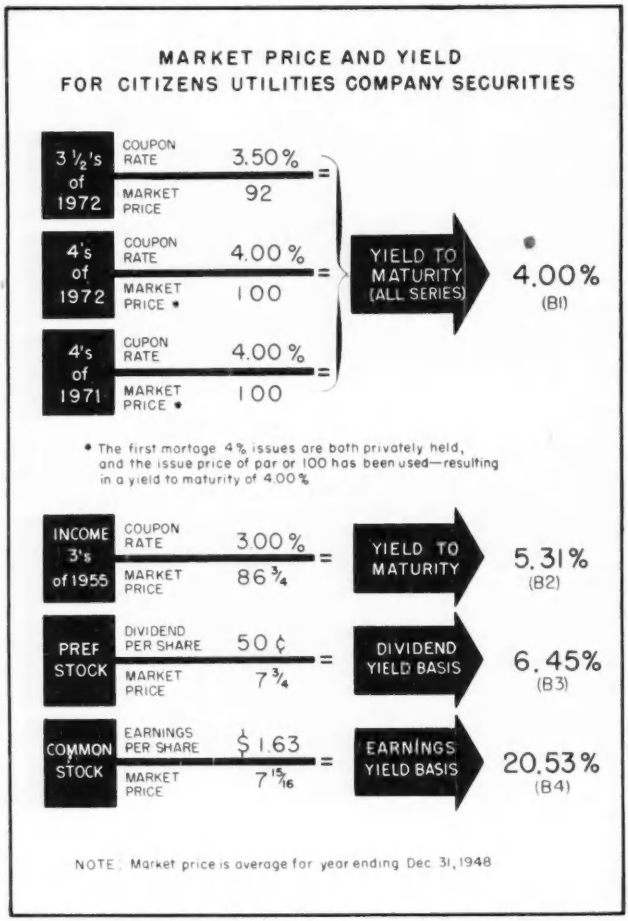


CHART 2—THE PRICE which investors are willing to pay and the return they receive

which permits production, transmission and distribution of its products at lower costs.

In fact, the "Report of the Committee on Rates of Public Utilities" made to the National Association of Railroad and Utility Commissioners in 1946, stated "In the determination of a fair rate of return . . . a rate increase (may be) not only warranted, but imperative in order that the company can provide the maximum service for which it was organized. We are entering an expanding market for the uses of electricity and gas and *unless a company is in a position to readily finance the expansion the public interest will suffer accordingly.*" (Italics supplied).

But all the recent trends in Commission and court decisions have still relegated the answer as to *what* percentage rate of return will accomplish these end results to the field of subjective and, for that reason, necessarily speculative opinion. It is the writer's thesis that the proper approach to what is a "fair" or "reasonable" rate of return will transfer this question from the realm of questionable speculative opinion to the reality best expressed by the formula: "Fair" or "reasonable" rate of return equals rate of return which is required.

At first reading, this brief formula may seem even more esoteric and subjective than the Commission and court answers, which have been so characterized by the writer. But the translation of the formula to a most precise kind of calculation, completely devoid of any element of subjectivity or personal opinion, is easily and quickly accomplished.

Our equation defines "fair" or "reasonable" rate of return as required rate of return. And required rate of return can most easily be defined as that rate of return which a utility must have to succeed in attracting additional capital by the standards of the "cold, bloodless verdict of the market place." This verdict of the market place provides the *only* basis on which investors would be willing to provide a utility company with additional funds. Therefore, the proper interpretation of what investors are willing to pay for existing, issued and outstanding securities of a company is the measure of the *only* rate of return basis on which investors would be willing to commit additional funds in the same proportion to a particular company.

The funds which a utility company uses in its business consists of borrowed funds (bonds or notes); preferred stock, if any; and common stock and surplus. This last category is properly stated as the total of the par or stated value of capital stock, plus capital surplus and earned surplus. The sum of these three classes of securities, if all exist in a corporate capitalization, constitute the funds which investors have either put into the business, or have permitted to remain in the business, in the case of earned surplus.

Present prices for these securities, of course, represent the only basis for measuring the prices which investors would be willing to pay at a proximate date for additional amounts of the same or comparable securities, if these were to be issued aggregately in the same proportion that they exist in the company's capitalization as of a definite time. Relation of these prices to either the coupon rate, with respect to bonds or notes, the dividend rate, with respect to preferred stock, and the balance of earnings available, with respect to common stock, indicates, in the most conclusive fashion possible, the yield basis on which investors would supply additional capital to the particular utility company.

In turn, this yield basis for a particular class of security, multiplied by the proportion of the total capitalization which the class of security represents, gives an end figure for each class of security which, when added, shows the composite "rate of return" basis on which the company's capitalization is selling. In turn, this composite "rate of return" basis shows in very precise and finitely measurable terms the earnings basis —in fact, *the only basis*—on which the particular company can obtain from the nation's investors additional funds for use in its business. The proposed test or measurement is not a matter of opinion. It recognizes the one fact which is conclusively basic: **A company can *only* sell securities at prices (and yield or price-earnings bases) which investors are willing to pay for them!**

Because the development of this thesis originated with the writer's responsibilities as President of Citizens Utilities Co, it would seem appropriate to apply the measurements in detail to that company.

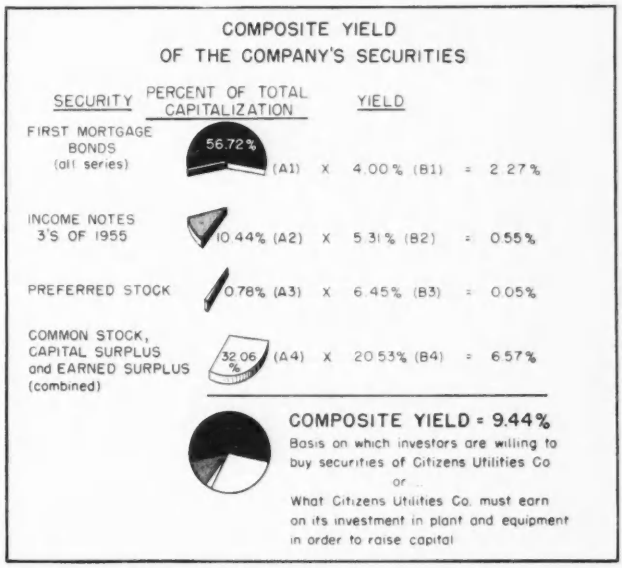

COMPOSITE YIELD
OF THE COMPANY'S SECURITIES
SECURITY
PERCENT OF TOTAL CAPITALIZATION
YIELD
FIRST MORTGAGE BONDS (all series)
56.72% (A1) X 4.00% (B1) = 2.27%
INCOME NOTES 3'S OF 1955
10.44% (A2) X 5.31% (B2) = 0.55%
PREFERRED STOCK
0.78% (A3) X 6.45% (B3) = 0.05%
COMMON STOCK, CAPITAL SURPLUS and EARNED SURPLUS (combined)
32.06 % (A4) X 20.53% (B4) = 6.57%
COMPOSITE YIELD = 9.44%
Basis on which investors are willing to buy securities of Citizens Utilities Co
or ...
What Citizens Utilities Co. must earn on its investment in plant and equipment in order to raise capital

CHART 3—THE RATE OF RETURN for each class of security derived from data on charts 1 and 2. The percentages from charts are identified by references A1, B1, etc

Capital Used by Citizens

Chart 1 sets forth, as at December 31, 1948, the capitalization of Citizens Utilities Co—that is, all of the capital which the company was using in its business—together with the proportions which each class of fund bears to the total. Chart 2 sets forth the average bid prices for these securities in the year ended December 31, 1948. The yield basis for securities of Citizens Utilities Co based on the average high and low bid prices is also shown in Chart 2.

The composite rate of return basis arrived at in Chart 3 provides a pragmatic, factual and *exact* measurement of the rate of return required by Citizens Utilities Co, if it is to be able to obtain capital from investors with which to add to its facilities for the two primary purposes: (a) Adequately to serve increasing demand; or (b) promptly to reduce cost by substituting the most up-to-date and lowest cost methods and equipment for obsolete and uneconomical methods and equipment.

It presents the *only* realistic measurement of required rate of return, because it shows the *only* rate of return basis on which investors are willing to provide this company with additional capital, raised in a composite fashion in proportions similar to those which now exist in the company's capital structure.

A current compilation as of this writing, early August, 1949, calculates out to a required rate of return of 9.8%, based on prices for securities of Citizens Utilities Co as of this date. However, security markets have been irregular and depressed in the last few months—wherefor, it is believed that average prices for the past year provide a more reasonable measure of proximate likely expectancy.

This conclusion as to investor-required rate of return has another importance. Because a company can obtain long-term or permanent funds *only* from the investing public, it, therefore, has only two alternatives. The first is to direct its capital expenditures into those segments or areas of its operations in which there will be produced, overall, the investor-required rate of return. If it cannot do this, it *must* take the second alternative and choose not to make *any* capital expenditures, in order that it may avoid the necessity of *attempting* to sell additional securities to raise additional funds.

This is the essential, continuing dilemma of any utility company. It must either have rates which will permit it to earn the rate of return on additional funds which investors, by the prices they are willing to pay for its present securities, indicate the company must obtain, in order to get investors to purchase the additional securities which the utility company must issue to raise the necessary capital funds, or it cannot successfully sell any additional securities without diluting the interest of present stockholders and, therefore, cannot properly raise additional funds for capital expenditure purposes.

Whether a company likes it or not, these are the economic "facts of life" as they apply to its continuing growth. There is no alternative, no way to avoid them. For if a company seeks to ignore them or blindfold itself with regard to them, the company very shortly finds that it cannot raise additional capital; and the consumers in the areas in which it operates find that, therefore, the company does not have funds and cannot raise the funds with which to pay for the costs of capital improvements, additions, and replacements necessary to its continuing progress.

Because it is devoted to public service, a utility company, by Commission regulation, is under the requirement of making certain minimum-distance extensions to serve consumers; and is also under the requirement of providing present and prospective consumers with such quantity of a particular commodity (electric, gas, telephone service, or water) as the consumers require. Thus, there is a constant and continuing capital requirement. To meet these necessities of public service, the body of the utility company must constantly have replenishment in the form of ability to raise sufficient amounts of capital.

But for each company the rate of return basis on which capital may successful be raised is different. It is not pointful to advise any *individual* utility company that the "average" of companies operating in a state, an area, or the country as a whole, indicates ability to raise new capital by selling securities on a composite 6¾%, 7% or 7½% rate of return basis. For an *individual* utility company does not sell securities on the basis of the yield of the "average" of all companies. It is, fortunately or unfortunately, in a position that it can only sell what it has or can create—which is its own securities. And by the very limitation of being able to sell only its own capital instruments, it must sell them on the composite rate of return basis on which investors will buy them—not the basis on which the average of all securities of all companies is selling. The *individual* company does not have the "average" security to sell!

Capital Structure of Citizens

It is believed that Citizens Utilities Co. for example, is conservatively capitalized. At December 31, 1948, it had over 32% in common stock and surpluses; and only 56% in mortgage bonds. It had approximately 10% in junior debt—its Income 3's. It would appear that these capital proportions could not be substantially improved at the present time. The substitution of a preferred stock issue for the junior Income 3's, under market conditions as of this writing, would probably require a dividend rate very close to the 5.31% yield to maturity of the Income 3's. Inasmuch as the Income 3's constitute only 10.44% of the total capitalization, even the ability to sell a preferred stock on a slightly better than 5% basis would not materially affect the composite required rate of return.

Method Applied to Others

Now contrast the investor-required rate of return (which the writer contends is a "fair" or "reasonable" rate of return for Citizens Utilities Co) with the required rate of return indicated by a similar calculation for other companies, based on December 31, 1948 balance sheet data and income account and average securities prices for that year. A random selection follows:

Community Public Service, which operates electric, gas and water properties in 155 communities in Texas, New Mexico, Louisiana and Kentucky, with total operating revenues of approximately $6,500,000, requires an *8.27%* rate of return.

Missouri Public Service, which operates electric, gas and water properties in 95 Missouri communities, with total operating revenues of about $4,000,000, requires a *9.96%* rate of return.

California Pacific Utilities, which operates electric, gas, water and telephone properties in California, Oregon, Nevada, Wyoming and Idaho, with total operating revenues of about $3,500,000, requires *7.56%*.

Mountain States Power, which operates electric, gas, telephone and water properties in Washington, Oregon, Idaho, Montana, Wyoming and South Dakota, with total operating revenues of approximately $8,500,000, requires *7.19%*.

Laclede Gas Light, which operates a mixed gas property serving the City of St. Louis, with total operating revenues of about $15,000,000, requires *8.85%*.

At the other end of the scale, some of the older, very large utilities, which are in the prime classification with respect to investor regard, can meet investor requirements by achieving a return of less than 5%, as determined by calculations as described above. One large New England electric company with total operating revenues of about $15,000,000 would require a rate of return of only 1.79% evaluated by this approach. A large midwestern electric company with total operating revenues around $100,000,000 would require only 4.83%.

Thus, each company has a required rate of return of its own. Some companies can finance on a composite yield basis for less than half of what investors require of other companies. The company in the prime classification may be able to operate with a low rate of return as of a particular period; but at the same time many companies in the secondary classification must obtain a much higher rate of return, if they are to finance without confiscating or diluting stockholder equity.

Thus, this fundamental and realistic approach to the question of "reasonable" rate of return for a utility company indicates that a pragmatic, specific and exact answer can be obtained by the proper interpretation and interpolation of the market prices for the securities of a company and the proportions which various classes of securities represent in its total capitalization. Investors, by the prices they are willing to pay for securities, dictate to companies the rate of return which companies *must* obtain, both with respect to present operations and investment and prospectively, with respect to capital expenditures which they plan or contemplate. Companies and commissions would do well to recognize the inescapable finality of market place judgment in this regard, if the companies and commissions expect investors to provide the wherewithall which companies must use to meet the service requirements of their consumers by adding to, improving and replacing plant and equipment.

Company May Dilute Earnings

If a company is not permitted by commission regulation to earn its required rate of return and it nevertheless proceeds with a substantial expenditure to add to or replace facilities or extend service areas, the company will be diluting the interest in earnings of its owners—its present stockholders. Such a dilution would be confiscatory in a very real sense. In other words, if a company can only earn, say, 7% on its rate base, and the sale of securities in proportions similar to the present propor-

(Continued on page 106)

THE NINE GUIDES

1. Preparation must always be made for forced outage of any single piece of equipment or any single circuit, pole line or tower line.
2. If a feeder serves only two or three customers, it must be possible to restore half of any load dropped by an outage on it within approximately 3 hr and all of the load dropped within approximately 12 hr.
3. If a feeder serves numerous customers, it must be possible to restore essentially all of the load dropped by an outage within approximately 3 hr.
4. For loads above 2,000 kva (one feeder) and up to 6,000 kva (three feeders), interruptions must be limited to the period required for operation of automatic, service-restoring apparatus capable of restoring all of the load interrupted. This would be a matter of 1 or 2 min at the most.
5. For loads above 6,000 kva (three feeders), full automatic duplicate service must be provided; no interruptions are acceptable.
6. Any arrangement must permit effective coordination of fuses, automatic disconnecting switches, automatic breakers and associated relays and controls.
7. Provision need not be made for faults on substation buses or on equivalent short-sections of lines.
8. If any facility requires more than one week for repairs, provision must be made for overlapping outage of any other facility.
9. The total of installed kw capacity shall not be less than the peak kw load, adjusted for load diversity and increased by 15%.

Nine Guides for System Planning

A discussion of the standards that form the basis of system planning. . . . Defines margins of spare capacity required to assure reasonable continuity of supply

ROBERT G. HOOKE
Transmission Planning Engineer
Public Service Electric & Gas Co
Newark, N. J.

UNDERLYING the recommendations of system planners there must always be a carefully defined balance between service and cost. Customers are increasingly exacting in their requirements for reliable supply because they are increasingly dependent on electricity. Designers of lines and equipment have learned over the years how to make their products more nearly failure-proof; but still faults occur. Costly spare facilities must, therefore, be provided. How much spare shall the Planning Engineer call for in the many elements of the system under his purview in order to satisfy the customers' demands for high grade service? What fault conditions shall he design to meet? Obviously, one of his major problems is to rationalize the margins by which capacities should exceed loads.

In the 1930's much thought was given to methods of reducing the margin of spare in the plant. Efforts were made to determine what the community could afford to pay or would wish to pay to avoid an interruption of, say, one kilowatthour. The planning engineers evolved a new unit known as "interruption kvah avoided", and it was proposed to compare the merits of each increment of system capacity on the basis of the investment cost, or the annual charges on the investment, per "interruption kvah avoided".

The number of "interruption kvah avoided" was determined in each case from probability studies based on the best available failure-rate information, load duration curves and seasonal variations of loads and ratings.

Although there were difficulties with the process, the efforts were not wasted. They demonstrated major inconsistencies in system planning. There appeared to be an investment of some $50,000 per "interruption kvah avoided" for spare substation transformer capacity above two transformer banks as compared with $253 for spare subtransmission capacity above a minimum of two lines to every substation. This irrational disparity was, of course, due to the

Adapted from a paper on the subject before the Electrical Equipment Committee of Edison Electric Institute at Chicago.

fact that the probability of transformer failure was much less than the probability of transmission failure. The same design standard—namely always prepare for one outage—had been applied in both parts of the system.

These studies also enabled engineers to put differential dollars on the known fact that the number of units serving any given load has its effect on the probability and magnitude of interruptions and therefore on the value of the spare. In a typical underground subtransmission system, adding a third circuit when loads exceed the capacity of a single line costs about $200 per "interruption kvah avoided," as compared to $5,000 when a fifth cable is added because loads exceed the capacity of three cables.

Establishing Standards

With this background, let us consider the problem of establishing some kind of standards by which those responsible for planning and design might be guided. We should like to be able to arrive at the simple mathematical probability of one kilowatthour of load being interrupted due to trouble in each specific system element. But the ratings change, the system design changes, and the failure-rates change. The probability of failure of a cable or a transformer is rarely the same as the probability of a service interruption. Furthermore, even if the data for rigid mathematical analysis were available and the procedures were worked out, the man-hours necessary to produce the answer could not be found in these high-pressure times.

The result is a largely empirical body of rules first set up informally by a Planning Group about two years ago. They have been a most useful guide and they have attained a status such that the simple statement that any plan does not meet our Service Standards usually condemns it to oblivion.

The thinking starts with the thesis that present service is satisfactory—it must not be allowed to deteriorate; large expenditures to improve it are not justified. Over the five years ending December 31, 1948, our interruption statistics* are as follows:

No. of Customers Interrupted for all causes per year per 100 Customers served	38
Average Duration of each Customer Interruption—Minutes	52
Average kvah lost per year per 100 Customers Interrupted	67

This result has been achieved with all planning based on what is the first and most fundamental empirical assumption:

1. *Preparation must always be made for forced outage of any single piece of equipment or any single-circuit pole line or tower line.*

Wholly on the basis of experience, it was decided that this was a satisfactory foundation stone for an edifice of rules. Through changing ratings and procedures, it had worked. It was reasonable to plan on it for the future.

One other stone was needed, to define the unit of load which it would be acceptable to drop and the conditions under which such outage would be tolerated. This too was found in past experience.

4-kv Distribution Circuits

In the 4-kv distribution plant definite standards in providing cutover facilities had been developed over a period of years:

2. *If a feeder serves only two or three customers, it must be possible to restore one-half of any load dropped by outage of it within approximately 3 hr and all of the load dropped within approximately 12 hr.*

3. *If a feeder serves numerous customers, it must be possible to restore essentially all of the load dropped by outage of it within approximately 3 hr.*

These two rules establish an interruption tolerance which is believed to be acceptable to electric customers. They fix the size of the load which may be dropped for any fault as that which may be served by a single distribution feeder. The great majority of the circuits are 300-amp capacity, although a few, serving heavy individual customer loads, are as large as 600 amp. Of course, one must be guided by the impracticability of providing completely firm service to the thousands of customers on 2,000-kva radial distribution lines. Radio troublemen can get open-wire lines back in service in a maximum of 3 hr, ordinarily very much less; if the faults are in underground portions of lines, cutovers to other circuits are maintained so that loads can be transferred in a like period of time. When this is not feasible, the secondary network takes over to provide firm service except for localized secondary failures or troubles on services.

Perhaps the most important element in this distribution planning is the fully equipped spare feeder position in the substation to which there is connected an outgoing "tie feeder." The latter becomes a spider-like circuit, its legs reaching in many directions to points just beyond the underground, near-station lengths of numerous radial lines, thus covering against possible cable faults. As a result of this practice, loadings approaching 100% of the aggregate ratings of all the distribution circuits in a large substation are frequently achieved; there is no need to retain unused spare capacity in these circuits to provide for large distribution cutovers when one of them is unavailable for any reason.

Distribution Substations

The three principles so far enumerated also set the pattern for the use of any single-transformer substations and the related transmission by which they are supplied. It has merely been decided that the service rendered must be as good as would be supplied by a distribution feeder, and cutover and backup facilities are provided accordingly. Whether or not it is as good, is not actually known as yet. It is assumed that it is, but no analysis based on the probability of outages of the component facilities on which service depends has been attempted. These small substations are very new on the system. What troubles they will give are not yet known and, while the line outage statistics needed for a probability study are obtainable, there is doubt of the reliability of the assumptions

* Interruptions due to 1944 hurricane and 1948 sleet storms are omitted.

which would have to be made regarding apparatus trouble-rates.

The application of the unit-type substation, tapped to subtransmission lines, tends, of course, to convert the 13- and 26-kv lines into super-voltage distribution circuits. Obviously, there is here a grave possibility of service deterioration, for the load supplied from such a line may reach 12,000 or 15,000-kva and also the time required to repair faults may be very much longer than for lower-voltage circuits. Hence, it is desirable to establish certain rules for the installation of unit-type substations:

4. *For loads above 2,000 kva (one feeder) and up to 6,000 kva (three feeders), interruptions must be limited to the period required for operation of automatic, service-restoring apparatus capable of restoring all of the load interrupted. This would be a matter of one or two minutes at the most.*

5. *For loads above 6,000 kva (three feeders) full automatic duplicate service must be provided; no interruptions are acceptable.*

6. *Any arrangement must permit effective coordination of fuses, automatic disconnecting switches, automatic breakers, and associated relays and controls.*

7. *Provision need not be made for faults on substation buses or on equivalent short-sections of lines.*

Guides 1 through 6 prevent the loading of a large number of small substations on a single 26-kv circuit in such a way that numerous customers might be interrupted for long periods by line or equipment failures. They force the planning engineers to guard against transformer failure by providing adequate backup on the low voltage side of any single-transformer substation. This is usually accomplished by extension of the "tie feeder" from an adjacent large substation so that it can take over the entire load of the single transformer installation if need be. The picture again is one of multiple use of a single spare. Of course the line extension needed to provide the backup is, in most cases, readily obtainable by use of the copper released when the unit substation is placed in service. This copper is not available to carry other load, but the position formerly utilized at the "mother-substation" and the transformer capacity there are both released for other use.

The planning engineer must also, under these standards, provide transfer facilities for his unit-type substations, as soon as he connects more than one (assuming 2,000-kva rating) to any 26-kv line. He may either arrange an automatic throwover to an adjacent line, on another pole line according to Guide 1, or he may call for automatic, no-load, sectionalizing devices capable of splitting the line and picking up all the load through good portions of the circuit. Relay men prefer to limit the latter practice to two such sectionalizing points in any through circuit.

Bus Faults

Guide 7 has been the subject of very recent discussion. In most of the larger substations and in all switching stations, provision is made for bus faults, although often not to such an extent that the loads can be carried indefinitely with a complete bus section out of service. In small substations, however expenditures specifically for bus sectionalization and differential protection are not considered justified. This is the old matter of cost per "interruption kvah avoided." In practice, there is a size-limitation in the application of this guide, but for small substations, it is considered fully acceptable, and it answers a series of questions which have to be answered in planning substation developments.

There remains one more of these fundamental, though largely empirical concepts, which, with its ramifications, guide our system planning engineers.

8. *If any facility may require more than one week for repairs, provision must be made for overlapping outage of any other facility.*

The ramifications of this rule are interesting. In a substation containing a synchronous condenser, the load on the transformers may be reduced very substantially by use of the condenser. Should the condenser require major repairs, however, it may be unavailable for a long time and there is probably no spare condenser which can be installed in its place. Meanwhile, a transformer failure may occur. Therefore, in determining when new transformer capacity is needed in the substation, no credit is taken for the load reduction normally resulting from the use of the condenser. If, on the other hand, the reactive capacity is provided by banks of static capacitors, full credit is taken for the load reduction which they accomplish because any failure of the installation can be repaired in a few days at the longest. Thus, the use of static capacitors defers the installation of transformer capacity, but the use of synchronous condensers does not.

As to the transformers, themselves, they are almost invariably three-phase units and after a failure emergency ratings apply on the remaining banks. But, even though it may take many weeks to repair the faulted unit, no provision need be made for a second failure because a stock of these units is carried and a replacement can easily be installed in less than one week. Incidentally, emergency ratings for substation transformers are very liberal and loads should never be allowed to exceed them except for the brief intervals which may be necessary for an operator to start fan cooling in an attended substation with a non-automatic fan installation. Fans are also used on circuit breakers to secure higher ratings and postpone installation of larger capacity facilities.

Subtransmission

In the subtransmission system provision is made for the loss of two circuits on any double-circuit pole line located on a traveled highway. If, the two circuits are on steel towers and shielded by higher voltage lines, however, provision is made for only one circuit out at any time. The same factors as for substation transformers apply in determining the loads at which new subtransmission lines are required, ie, no credit is taken for the load carried by synchronous reactive capacity because of the possible long outage period, but full credit is al-

lowed if static capacitors are installed.

On these subtransmission circuits, in addition to an emergency rating which is based on the load carried prior to any fault, there is a special 2-hr rating. This latter rating is applicable when loads can be transferred from a transmission network in trouble to another adjacent transmission group. No matter how large these transmission networks become, provision is never made for overlapping line outages. This is in accord with Guide 8, since line outages can be repaired in a short period of time. It may be said that this policy is in a marginal area. There are occasional overlapping outages of lines in large networks, especially during lightning seasons or when some of the cables may be as much as 40 years old. However, the capacities of the individual supply circuits are always small in relation to the total load served by the group. Therefore, there are only a few hours in the year during which overlapping outages are embarassing.

Bulk Power

It now remains to discuss the policies applied in the bulk supply portions of the system. The Federal Power Commission's Area 5 has a total installed capacity of 4,587,000 kw. In this area, it has been decided to plan for a reserve capacity equal to 15% of the forecast load. This decision is based on studies of maintenance requirements and experience with forced outages, the summer maintenance periods being critical equally with the non-maintenance, peak-load periods. For the individual company the rule becomes:

9. *The total of installed kilowatt capacity shall not be less than the peak kilowatt load, adjusted for load diversity and increased by 15%.*

The peak load in the Public Service system in 1948 was 1,167,000 kw. The diversity adjustment was 23,000 kw. Hence, the spare requirement was $0.15 \times (1{,}167{,}000 - 23{,}000) = 171{,}600$ kw, and the installed capacity should have been 1,338,600 kw. This compares with an actual effective capacity of 1,390,300 kw.

Since the two largest Public Service machines have an aggregate capacity of 240,000 kw, it is possible to meet the interconnection obligations without meeting the requirements of Guide 8; a generator may be forced out while another is undergoing a long overhaul (more than one week). From the system capacity standpoint, this is acceptable because 15% of the load of the entire area (15% of 4,193,000 kw = 629,000 kw, in 1948) is much greater than the sum of any two units. The capacity of the interconnections is adequate to make up any local deficit and from the standpoint of the system as a whole Guide 9 supersedes Guide 8.

Reactive capacity is provided according to a similar rule except that there is no adjustment for load diversity because reactive interchange between interconnected companies is not contemplated or practical. The forecast peak reactive demand in 1948 was 862,000 kvar, and the installed reactive capacity about 1,000,000 kvar or 115% of the load. (Actually the load reached 900,000 kvar; more reactive capacity will be provided this year in connection with a new generator). Here again the practice does not meet the requirement of provision for overlapping outage of the two largest supply units, two generators with aggregate reactive capacity of 150,000 kvar. However, the margin of failure is small and will disappear in the future as loads grow while the sizes of the individual units installed to serve them tend to increase less rapidly. It is believed that this policy of providing for reactive demands on the same basis as for kilowatt demands, including 15% spare, is relatively uncommon in the industry.

Load Area Supply

The planning standards outlined here apply without modification in designing the supply to Public Service Electric & Gas Co's nine load areas each of which is served from one or more bulk-supply stations. No provision is made for complete loss of such a supply source but provision is made for loss of any element in the supply and for overlapping outages if one or more of the elements is out of service for more than a week for repairs.

Typical of outage conditions contemplated in load areas are the following, any of which may be either scheduled or unscheduled:

A. Single outage of any 132-kv transmission circuit, transformer unit or turbine-generator.

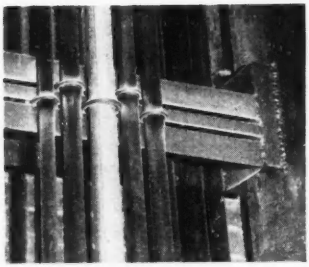
B. Simultaneous outage of any two 132-kv transmission circuits on the same tower line.

C. Overlapping outages of:

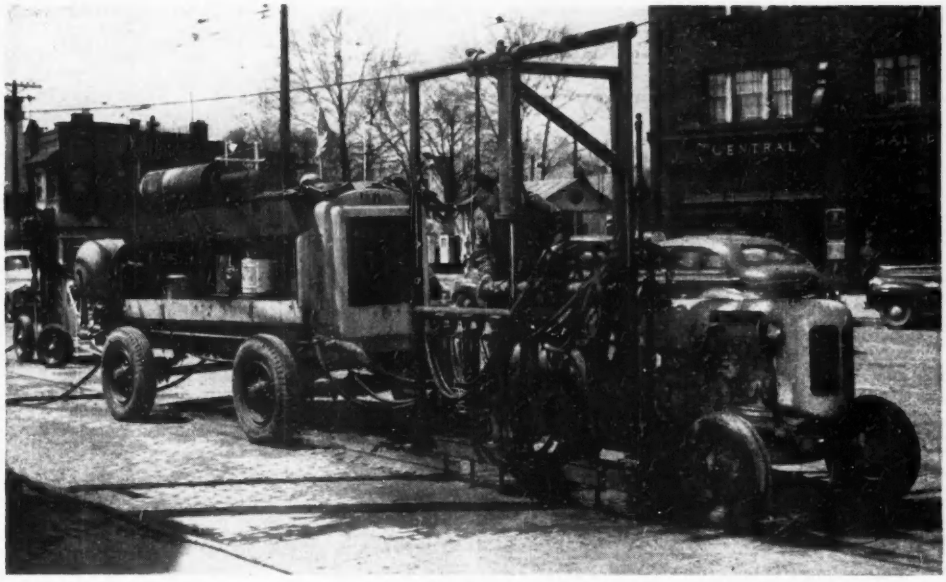
a. Two turbine-generators
b. A turbine-generator and a transformer unit
c. A turbine-generator and a 132-kv transmission circuit
d. Two transformer units
e. A transformer unit and a 132-kv transmission circuit

A condition of the assumed multiple outages is that the second does not occur until at least a week has elapsed after the first, during which time any feasible relief measures may be taken. This limitation on the possibility of multiple outages is based on a mathematical analysis of the probabilities of transformer failures in switching stations.

Double Slotted Hanger Reduces Conduit Spacing



WHERE THERE IS a problem of running a large number of iron conduits in a minimum space, double slotted conduit hangers will do the trick, as in this case in the Ashley Street Plant of Union Electric Co (St. Louis). Duplicate slots prevent interference between U-bolts and permit placing conduit on minimum lock nut centers. Conduit can be supported in this manner in either the vertical or horizontal plane



LINE-DRILL MACHINE powered by compressed air drills six holes in pavement simultaneously in preparation for pavement removal

Purchasing Department Focal Point Of Mechanization Program

Intensive development and adaptation of heavy construction machinery saves utility large sums in maintenance and capital outlay

J. C. STRASBOURGER
General Assistant to the Purchasing Agent
The Cleveland Electric Illuminating Co

BY MEANS of an intensified mechanization program, The Cleveland Electric Illuminating Co has been able to save several hundred thousand dollars annually through reduced maintenance and capital investment costs. During the war and the postwar period, great advances were made in the development of mechanical devices. The correct machinery properly applied will reduce costs and, in most cases, complete the job faster and more safely.

Manufacturers are more interested in considering some of our special problems, and in assisting in the development of new equipment required in our work.

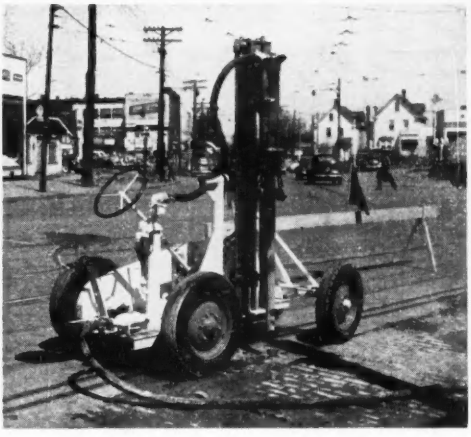
We believe it will generally be found economical to use new mechanical methods, where previously, additional machinery would have increased costs above those of older methods or hand labor.

Our management, therefore, appointed a special committee to initiate and sponsor a company-wide mechanization program. The group assigned to direct this activity included upper level executives, department and division heads, and engineering specialists. The special assistant to the purchasing agent acts as secretary of the committee.

The purchasing department was found to be the logical contact point for a mechanization program. This program made available the many sources of information from vendor contacts, and greatly facilitated arrangements for loans, tests and demonstrations of new equipment and for development of new machines.

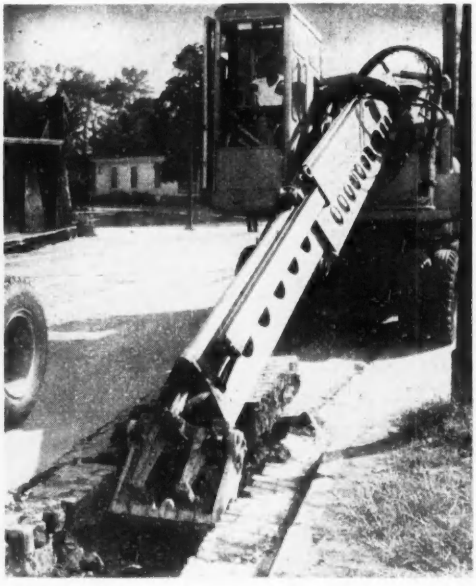
Our attention was first directed to underground subway construction operations, because, in this field, large amounts of earth, sand, cement, pavement and other materials had to be moved, and because a shortage of manual labor existed. These operations were causing delays in completion of facilities which were a vital part of our expansion program.

Pavement and earth removal facilitated by machinery . . .



Machine cuts web . . .

Le Roi broaching machine cuts pavement between drilled holes



Gradall strips pavement . . .

Machine strips previously perforated pavement with ease

We first tackled the problem of pavement removal. In cooperation with one of the large air-tool and compressor manufacturers, a machine was developed with six pneumatic rock drills on a pipe frame mounted on a tractor. A 600-cfm diesel-driven air compressor was attached to the tractor and supplied air to power the drills.

This device perforates the pavement by drilling a line of six holes on one-ft centers. The machine is then moved forward about four in. and the drilling operation is repeated. This produces a continuous line of holes clear through the pavement on one side. Another line of holes is drilled on the other side of the marked trench width.

Further development included a broaching device to cut the web between the drill holes.

Pavement Removed in Slabs

When the drilling and broaching operations are completed on a section, we have cut loose a continuous slab of pavement as wide as the trench to be excavated. This presents a bit of a problem, since such a slab is not easy to lift and load. We consulted our manufacturing friends, this time at a different company, and soon had our answer—a machine called the Gradall.

This truck-mounted machine, with a hydraulically-powered boom and buckets, will do things that are almost unbelievable. By equipping it with a special bucket, we can pick up 15-ft slabs of paving and load them into a truck as we might pick up match sticks. The boom and bucket assembly on this machine has the facility of a human arm and hand, but with a capacity rating in tons.

With line drill, broach and Gradall machines, we were able to reduce the cost of pavement removal about 85% as compared with the old method using pneumatic jack hammers and hand loading.

The Gradall machine was also found to be very useful for excavating trenches after pavement removal and for the excavation of manholes and holes for high line tower bases, particularly in unstable earth and stratified rock.

Earth excavation costs are approximately 95% lower with the Gradall than with hand shovel work, and 30% less than conventional trenching machine costs in city street excavations.

Another recent addition to our staff of mechanical helpers is a pneumatic machine to drive a line through underground cable ducts. No doubt some other companies are already using this device. Previously our practice was to push through a series of interlocking wood or steel rods. This was a slow, laborious hand operation and very expensive, particularly on long sections of duct. In about 2 min the new device shoots a neoprene cup and following wire through a 600-ft duct section. The cost of this operation has been reduced by about 97%, with work speeded up in about the same proportion.

Substantial Savings Indicated

The cost figures quoted do not include investment expense on the new equipment, but these additional costs will not substantially reduce the savings. We are dealing with thousands of square feet of paving and thousands of dollars. Translating the ef-

Loads slab on truck . . .

Telescoping boom of Gradall deposits the slab in the truck

Also pulls piles . . .

Same Gradall makes light work of pile and shore pulling

fect of this activity into operations of other companies will, no doubt, cause astonishment at some of the possibilities.

After proving the value of this program in our underground construction operations, it was extended to include the activities of other departments.

One of our newest applications is the use of a tilt-bed trailer. This unit is used to haul tractors and bulldozers needed in the construction of high tension, steel tower lines. A previous cost of approximately $50 per move has been reduced to about $10. Use of this trailer also permitted a line-cutover on a Saturday, which otherwise would have required an entire weekend.

There are many places where a portable winch or hoist can be used to advantage. We are continually on the lookout for such applications and have just purchased a relatively new type of portable electric winch. We are using it for moving and placing metal-clad and cubicle switchgear in a new generating-plant switch house. Actual cost reduction figures are not yet available, but we estimate that the saving on this job alone will more than pay for the winch.

We have many other devices and developments under consideration. A large number of smaller tools have been investigated, and several have been field tested and found to be very effective. When we suggest a new tool or device, we ask the supervisor involved to apply this relatively simple test:

1—Will it work?
2—Will it pay?
3—Is it safe?

If he thinks it has possibilities, we arrange a field trial or demonstration.

Concerted Attack

The entire staff of the purchasing department is keenly aware of this program and all new ideas or information are channelled to the committee. In addition, this writer scans a large number of trade magazines and new equipment lists and obtains information on any tool or machine which may be of interest. Vendors' representatives are encouraged to bring to our office any ideas or information which they think we can use. These sources have been very productive.

Descriptive pamphlets obtained from manufacturers or their representatives are circulated to supervisors who should be interested. Accompanying the pamphlet is an inquiry sheet which asks such questions as these:

Does this device have application in operations under your supervision?

Will use of this device facilitate performance of the work?

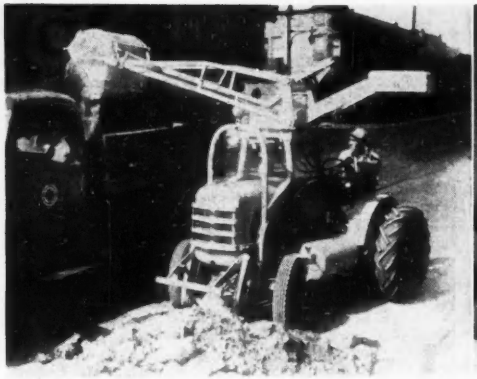
Will use of this device increase or decrease accident hazards incidental to the work?

The cost of one device is $. . . .

Do you think it would prove to be economically advantageous for use in your division?

Can you suggest any other company groups that might advantageously use this device?

These inquiries, after being filled out by the men in charge of specific functions, are returned to their respective department heads and may serve as a compelling argument for purchase approval. This procedure also counteracts any tendency to leave



Material is picked up

Swing loader picks up loose material for truck removal

Equipment drives lines through ducts

Special truck equipped for pneumatic duct rodding operation

MECHANIZATION PROGRAM EQUIPMENT APPLICATIONS

Number	Item	Use
1	Truck-mounted sheet puller	Pulling wood sheet piling
2	Piling pullers	Pulling wood sheet piling
6	Fibre tube lathes	Cutting ends on fibre ducts
1	Power earth conveyor	Excavation and loading
2	Swing loaders	Loading earth, sand and rubble
2	Pumps—Single diaphragm	Pumping water from excavations
1	Pump—Double diaphragm	Pumping water from excavations
1	Line oiler for pneumatic tools	Reduces tool maintenance
2	Air compressors, 315 cfm	Powering air tools
6	Utility carts—Pneumatic tired	Hauling light materials on street jobs
2	Pneumatic fish lines (rodding machine)	Rodding and cleaning duct preparatory to installing cables
1	Chain saw—Gasoline powered	Cutting poles, lumber, etc
1	Pipe locator	Locating cable faults Locating underground pipes
4	Thread cleaners	Cleaning threads on bolts
2	Star drills with accessories	Replaces hand star drills
1	Gradall and accessories	Pavement removal, excavation, etc
1	Line drill rig and broaching machine	Pavement removal
2	Hand trucks with pneumatic tires	Handling drums
1	Gas-powered blower	Exhaust steam from excavations
2	Pneumatic sump pumps	Pump water from excavations
1	Air hammer	Small pavement jobs
1	Power hack saw	Work in customer vaults and subs
1	Electric saw	Cut timbers for bracing
2	Portable generators	Portable tool operation for street work
5	Pipe benders	Conduit work in plants and subs
3	Portable drill presses	Electrical construction and maintenance
1	Jointer, 6-in.	Woodwork in shops
8	Enamel chutes	Convey cement in steel work
1	Concrete vibrator	Compact cement in duct runs and manholes
6	Lock line pliers (pairs)	Electrical work in plant
2	Small hoists	Electrical maintenance and construction
1	Tilt-bed trailer	Haul tractors and bulldozers
1	Truck consisting of: Truck Winch plus niggerhead Air compressor	Duct rodding and miscellaneous jobs
1	Portable electric winch	Electrical construction—Plants and subs
1	Portable gas powered pump, 3-in.	Pump water from manholes
1	Tractor with loader, mower and other attachments	Loading earth, grading, mowing weeds, etc
6	Cargotainers	Storage and shipment of tools and supplies

the material on desk tops or in bottom drawers for long periods of time.

A complete file of information is kept in the purchasing department and all supervisors are encouraged to call upon us for reference material or help in locating an answer.

We encourage the supervisors to originate suggestions which we will diligently follow up, and we advise the suggesters of ultimate disposition.

Field Demonstrations Convincing

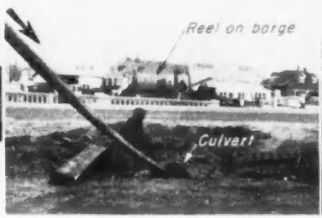
Sometimes an actual field demonstration is necessary to convince people of the advantages of various machines. Here's an example: We had one crew digging a hole in a street to make an excavation for an underground steam main repair. The steam leaking into the excavation made work almost impossible. We arranged to have a gas-powered fan with suction hose delivered to the site. In a few minutes the crew found they could not work without it.

Supervisors will sometimes say, "We have a satisfactory work method, with satisfactory tools, and it is economical. Why change it?" In such cases, the approach must be diplomatic, for suggestion of new methods may be taken as personal criticisms.

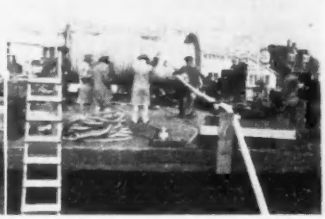
Our purchasing department has played a productive part in saving our company many thousands of dollars through our new mechanization program. We think any electric light and power company may similarly organize and conduct a new mechanization program, to the benefit and profit of all concerned.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

1. OFF THE FLAT CAR . . .



2. THROUGH THE CULVERT . . .



3. AND ONTO THE BARGE

Okonite Too Has Switched To Culverts

IT SOUNDS impossible but a contractor* for Jersey Central Power & Light Co recently transferred an 8,000-ft length of steel-armored 34.5-kv submarine cable, weighing 76 tons, from a flat car on one side, to a barge on the other side of the main highway (New York to Atlantic City) at Toms River without either crossing the highway or lifting the cable reel from the flat car.

*Jesse A. Howland & Sons, Inc.

How Job Was Done

The illustrations show how the job was done. The contractor simply located a culvert under the road, pulled the cable off the flat car, through the culvert and onto another reel on the barge.

The cable involved was Okonite-Callender, three-conductor 2/0, oil-impregnated, paper insulated submarine cable, 3.368 in. in diam, and weighing over 19 lb per ft. It was installed at Barnegat Bay from Seaside Park to the mainland.

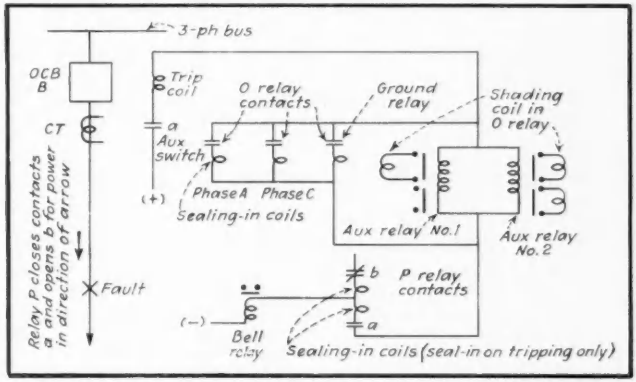
Wiring Scheme Improves Relay Coordination

JOHN I. HURSH
Auburn, Ind.

A WIRING SCHEME has been devised to improve power directional relay coordination. An example of proper functioning is the prevention of a breaker from being tripped when the power relay contacts are moving in the non-tripping direction.

Power Relay Included

Control equipment (see diagram) includes a power relay P which closes contacts on single-line faults. This relay depends on over-current relay O to determine normal load and fault conditions. Ordinarily the power relay, through auxiliary relays, closes the shading coils in the over-current relays. Thus, torque in the over-current relays cannot be provided until the power relay has closed certain contacts. In this manner directional control is secured.



COORDINATION of relay contacts is improved by these connections. In this single-line schematic diagram, coils are not shown for power relay P and overcurrent relays O

By the improved scheme of wiring, as soon as the power relay opens contacts, torque is removed from the over-current relay. Operation of the

devices takes place in this manner:

Only the normally open set of contacts *a* are used on the power relay. When this contact is closed it completes the circuit through the auxiliary relay coils and to an auxiliary switch and trip coil located on the breaker.

Tripping of Breaker Is Prevented

Auxiliary relay coils have comparatively high resistance and control the over-current relay. But this current is too small to pick up the bell alarm relay, trip the breaker or to seal-in the contacts of any of the relays. Thus, as soon as the power relay contacts open, the over-current relay torque is stopped and possible tripping of the breaker is prevented.

If power has persisted long enough in the tripping direction at sufficient current magnitude, the over-current relay will close its contacts and by-pass the auxiliary relay coils. Then sufficient current is provided to operate the bell alarm relay, seal-in the tripping contacts of the over-current and power relays and trip the breaker. The correct time and directional tripping is in this way assured.

This scheme of wiring has been used for both 13.8 and 34.5-kv overhead open-line and underground cable feeders for five or six years without any indication of incorrect operation.

Additional Advantage

With the auxiliary relay coils in parallel, this scheme has the additional advantage of assuring tripping if one of the auxiliary relay coils should fail. In that event the other auxiliary relay would close its contacts to permit some other phase over-current relay, or possibly the ground over-current relay, to operate.

DIFFERENTIAL GEAR cumulates the departure in power system frequency

Frequency Monitoring System for Interval Timers

A FREQUENCY MONITORING system devised at the National Bureau of Standards now provides a means by which any Bureau laboratory may obtain the proper correction to be applied to a commercial interval timer driven from the city power line. An accuracy of 0.01 second is obtained.

One serious disadvantage in the use of interval timers driven by synchronous motors has been the error caused by frequency variations in the local power system. Use of the frequency error indicator has eliminated this difficulty at the Bureau.

The Bureau's design makes use of the difference in speed of two 60-cycle synchronous motors, one driven by the power line and the other by a standard crystal-controlled frequency. The two motors are connected to a differential gear system. The angular velocity of the differential gear shaft thus depends on the departure of the power line frequency from the standard frequency. The position of this gear shaft at any instant depends upon the total integrated frequency error of the power line at that instant. This shaft is connected to indicating dial which are calibrated to give the cumulative error in seconds and hundredths of a second rather than in cycles. Since the cumulative error seldom drifts faster than 0.30 sec per min, the correction is precise within a very few thousandths of a second. An automatic recording device operated in conjunction with the system provides a complete charting of the frequency variation over the time interval when desired.

Organizing Load Tests On Transformers—I

TO CHECK distribution transformers against overloads and unbalanced loads an eastern utility maintains regular routines. All pole work in this connection is done by one or more men specially selected by the company's distribution department's assistant superintendent on request of its maintenance supervisor. When such men are to read or operate instruments as in measuring primary demands they must be given special instructions in their care and use before starting each season's work. This instruction is given by the meter superintendent or meter foreman. In all cases where pole climbing is unnecessary to read instruments a reliable man must be selected from the maintenance or meter department.

Every distribution transformer in single-phase service not having a temperature indicating device has its maximum demand measured on the primary side every four years. Each transformer equipped with a temperature indicator has such a device read and reset annually by the line inspector. Every three-phase transformer or bank of these having no temperature indicator is required to have its maximum demand measured on the primary or secondary side (whichever is most convenient) every two years. If a temperature indicator is in service, the transformer or bank has its maximum demand checked every four years. Where transformers are fed from the company's 13.8-kv system, this demand is measured on

when you don't need indication

THIS IS THE CUTOUT TO USE—

It saves you money!

This G-E non-indicating fuse cutout is the lowest in price of all wet-process-porcelain enclosed types. It costs less to maintain—with practically no moving parts. It is the sturdiest cutout built. You can stock fewer replacements—all contacts, fuse holders and other parts have been interchangeable for 21 years.

Backed up by an unexcelled operating record of performance efficiency, and durability, this cutout is the most reliable and economical type you can buy.

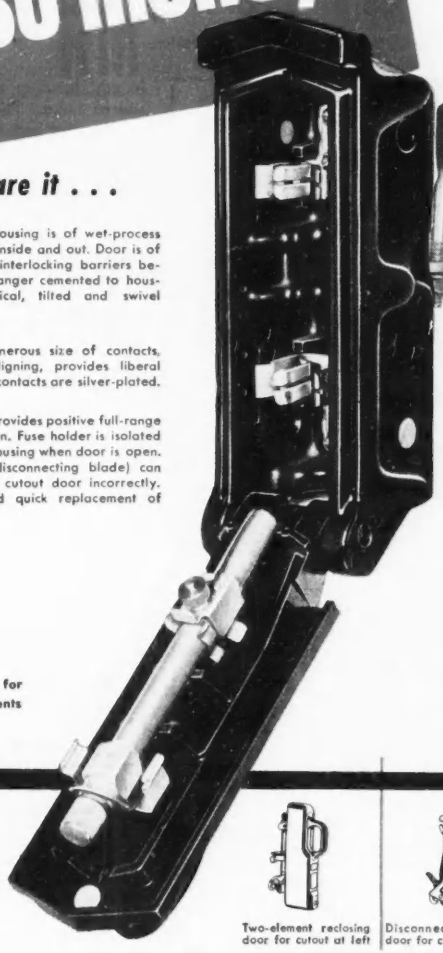
Stocked in 50- and 100-ampere, 5000-volt and 7500/12,500-volt Gr. Y ratings. For complete information, see your nearest G-E representative or write for catalog GEA-2390. *Apparatus Dept., General Electric, Schenectady 5, N. Y.*

Compare it . . .

MECHANICALLY—Housing is of wet-process porcelain glazed inside and out. Door is of Textolite. Double interlocking barriers between contacts. Hanger cemented to housing permits vertical, tilted and swivel positioning.

ELECTRICALLY—Generous size of contacts, which are self-aligning, provides liberal contact area. All contacts are silver-plated.

FUNCTIONALLY—Provides positive full-range current interruption. Fuse holder is isolated from contacts in housing when door is open. Fuse holder (or disconnecting blade) can *not* be placed in cutout door incorrectly. Enables easy and quick replacement of blown fuse.



Primary Fuse Cutouts for All Service Requirements

Enclosed indicating and drop-out fuse cutout

Two-element reclosing door for cutout at left

Disconnecting-blade door for cutout at left

Open-type fuse cutout with drop-out fuse holder

Flip-open fuse cutout

GENERAL ELECTRIC

the secondary side annually, including the load on every secondary circuit. No attempt is permitted to measure such a demand on the primary side. All such measurements are between Nov 1 and Jan 1.

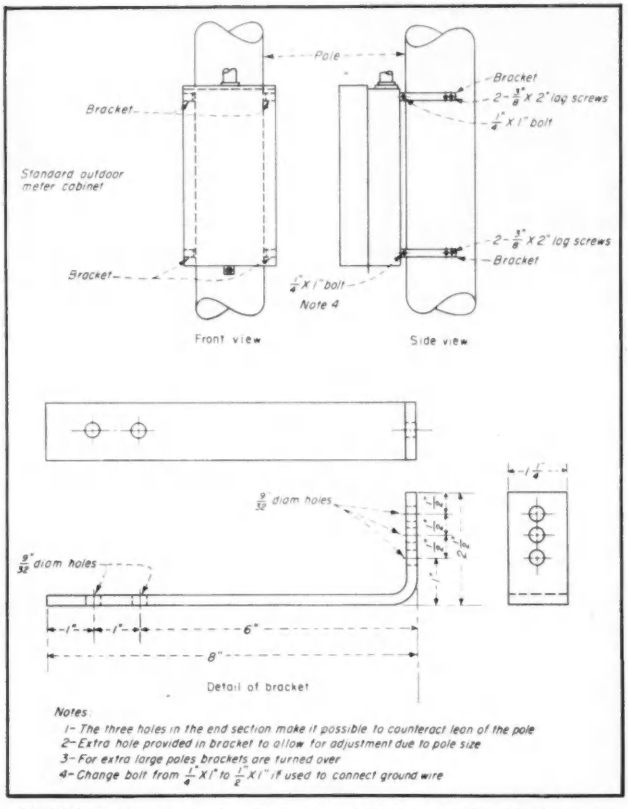
To facilitate the systematic making of these measurements the company's territory is divided into four sections, each being mapped under the direction of the maintenance supervisor and the maps kept in the operating department office. Each section is marked by the year and type of measurements required during that year. Thus, a typical marking is "Section A—1948, 1-phase primary, 3-phase with temperature indicators, 3-phase without temperature indicators—1949, 3-phase without temperature indicators." In addition, the maintenance supervisor is required to examine all temperature indicator readings of all transformers in the section where no routine tests are scheduled during the period. Also the supervisor is to have special tests made in all cases where the indicator reading is 80% or greater. All temperature indicators are also read yearly by the line inspector.

Load demand measurements on a transformer or bank serving one customer will be outlined in an ensuing issue.

(To be continued)

Improved Pole Mounting For Meter Cabinets

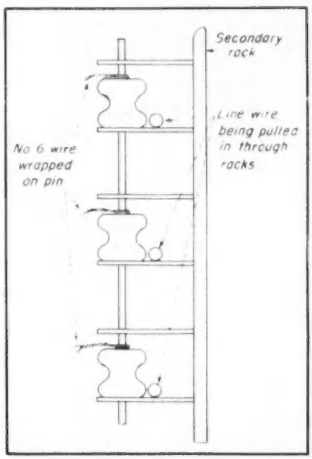
S. A. CUSHING, Meter Dept, Salem Electric Lighting Co


Pole
Bracket
2-5/8" X 2" lag screws
1/4" X 1" bolt
Standard outdoor meter cabinet
Bracket
2-5/8" X 2" lag screws
Bracket
1/4" X 1" bolt
Note 4
Front view
Side view
9/32 diam holes
9/32" diam holes
1-1/4"
1"
1"
6"
8"
Detail of bracket
Notes:
1- The three holes in the end section make it possible to counteract lean of the pole
2- Extra hole provided in bracket to allow for adjustment due to pole size
3- For extra large poles, brackets are turned over
4- Change bolt from 1/4" X 1" to 1/2" X 1" if used to connect ground wire

BRACKET for pole-type mounting of meters is made from crossarm brace by simple process

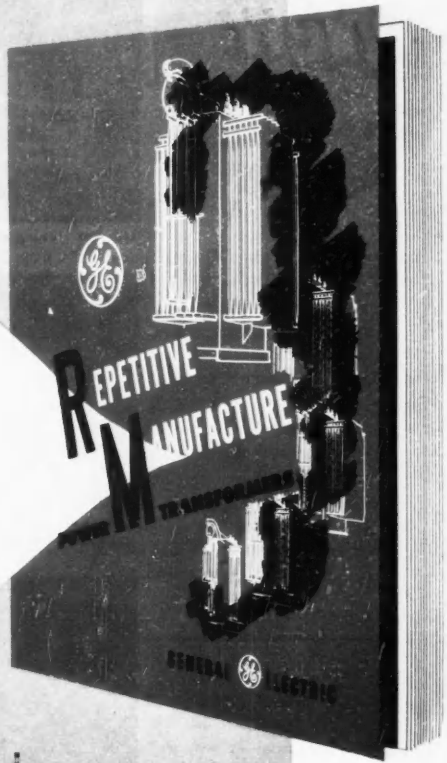
MOUNTING of meter cabinets of the outdoor type on company poles was formerly done by nailing a cross member, usually a piece of board, upon the pole and then using screws to hold the box in position. This has been improved upon by the use of right-angle iron brackets in which have been bored the necessary holes of proper size and location. These brackets can easily be made of old crossarm braces by cutting to proper length, bending and boring the required holes. They are then bolted to the meter boxes, dating nails being used to fasten to the pole. The result is a neater and stronger installation than the older method.

Prevent Wedging Of Wire On Racks



LINE WIRE, while being pulled into place, can be prevented from wedging between the spool and lower bracket on secondary racks. One method is reported by M. L. Monson, superintendent, Fosston Municipal Light & Power, Fosston, Minn. It involves use of short pieces of wire, usually about No. 6 WP. The wire is wrapped once around the pin between the porcelain insulator and the upper bracket. Thus the insulator is forced down to the lower bracket so that no space is available for the line wire to become wedged. Most of the racks can be remedied with No. 6 wire, but some racks have more space and a larger wire may be necessary around the pin.

HERE ARE ALL THE FACTS ON RM* POWER TRANSFORMERS



*Certain G-E power transformers, within the complete G-E line, have for a number of years been designated as "repetitive manufacture," or "RM" for short. These are standard transformers—that lend themselves to quantity production.

Through quantity production RM transformers can be built faster, at lower cost. Engineering and drafting for any particular transformer is already done—component parts can be mass-produced—jigs and fixtures are already on hand.

As a result, RM transformers can be delivered months sooner than non-RM transformers. Their prices are lower, by at least eight per cent, than specials of identical ratings.

"RM" transformers are available in ratings of 667 to 5000 kva, single-phase, and 750 to 10,000 kva, three-phase and with high voltages in accordance with EEI-NEMA preferred voltage ratings between 2400 and 67,000 volts. They are equipped with the most popular types of terminals and accessories.

A NEW 44 page catalog gives you

Prices • Ratings

Electrical and mechanical data

Application and selection data

Lists and descriptions of basic accessories and optional features

If you haven't received your copy of GEC-479, call your local G-E office or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

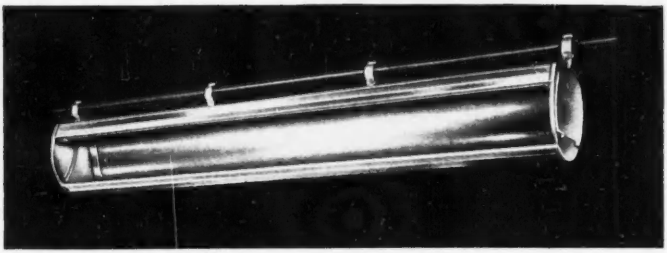
GENERAL ELECTRIC

what's

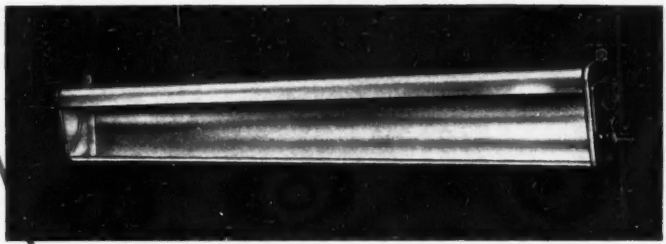
New

in

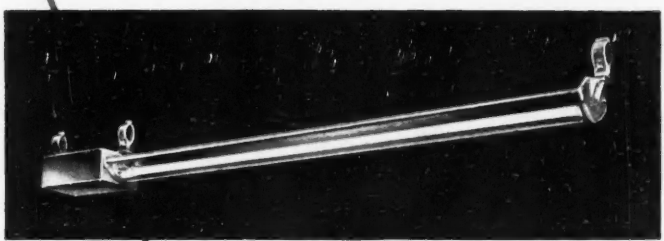
street lighting



Form 200 Luminaire for arterial lighting



Form 201 Luminaire for continuous-strip fence-height lighting of bridges, viaducts, roadways approaching airports and similar applicatons



Form 202 Luminaire for continuous-strip tunnel lighting

Another Achievement of General Electric Engineering

This is the first line of fluorescent luminaires optically designed for roadway lighting.

Fluorescent Luminaires for Roadway Lighting

Fluorescent Roadway Lighting as we see it —

Fluorescent lighting of streets has been successfully used in England; but its applications in the United States has been delayed for several obvious reasons. Weather and traffic conditions, installation problems, and maintenance costs differ greatly in the two countries.

Lighting authorities acknowledge that certain inherent advantages of the fluorescent light source should not be overlooked in the constant search for more and better roadway lighting. General Electric engineers fully realize that the use of fluorescent roadway lighting in this country, on a large scale, can come only after a thorough investigation and study of actual installations. This calls for the close cooperation of designers, utilities, and municipalities.

IMPORTANT ADVANTAGES OF FLUORESCENT

The fluorescent lamp is characterized by long life and high efficiency. The inherently low brightness of the fluorescent luminaire compared with that of any conventional luminaire having similar lumen output is an important factor in eye comfort. The extremely broad pattern of pavement brightness between the driver and the luminaire makes it outstandingly worthy of development and use in pioneer installations. The apparent light source of the new Form 200 luminaires has an area of 6 square feet compared with the conventional luminaire's area of ½ to ⅔ square feet. This should result in a new and higher degree of "comfortable seeing."

OBSTACLES TO BE OVERCOME

The use of fluorescent luminaires for roadway lighting entails new mounting and installation methods. The effect of low temperature on light output presents a problem which must be further overcome before the full inherent economies of fluorescent as used indoors can be realized in all outdoor applications.

OUR OBJECTIVE

It is with the full knowledge of the foregoing characteristics that engineers of the Illuminating Laboratory of General Electric's Outdoor Lighting Center at Lynn, Massachusetts, present this new line of luminaires for roadway lighting.

These luminaires are optically correct for their intended applications. They combine all that has been learned by engineers who developed the fluorescent lamp and by men of long experience in the design of street-lighting equipment.

It is hoped that leaders in the outdoor lighting industry will want to pioneer in this new field through developmental installations and thus help advance the progress of fluorescent lighting out of doors.

A General Electric Street-lighting Specialist is available to work with you. Ask your G-E apparatus sales engineer. Get in touch with him today. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

The Form 200 Luminaire for pole mounting will provide good visibility and Comfortable Seeing with modern practice in mounting height and spacing. Laterally, the distribution of light will be broad. Vertically, the main beam is directed outward at a high enough angle to provide good illumination and high pavement brightness between luminaires. The brightness of the luminaire at angles as seen by the motorist is low, providing Comfortable Seeing.

The Form 201 Parapet Luminaire is designed for use primarily where poles are objectionable or impractical. The luminaire is mounted at the driver's eye level and will produce good pavement brightness with complete shielding of the light source.

The Form 202 Luminaire is designed for use in tunnels or under-passes and may be mounted to provide continuous ribbons of low brightness light which produce excellent silhouette visibility.

GENERAL ELECTRIC

452-98

Impedance – Admittance Chart

THURSTON D. OWENS, Associate Professor of Electrical Engineering, Case Institute of Technology, Cleveland, Ohio

ACCOMPANYING CHART has been developed to convert an impedance in complex form to an admittance in the same form, or the reverse operation, for the solution of a-c circuits.

This chart, with the aid of a slide rule, will give the reciprocals of complex numbers expressed in rectangular form. Results can be obtained in either rectangular or polar form. The chart can also be used to convert a complex number from one system of coordinates to the other, when no question of the reciprocal is involved.

Construction of the chart is square with the length of each side equal to unity on a chosen scale. Two 90-deg arcs are drawn, each with a radius of 0.5 and centers at 0.5 on the x and y axes, respectively. A straight edge is used with a scale identical with the scales on the axes. It is extended from the origin (zero) to the right vertical or top horizontal scale. A degree scale with its center at the origin is included.

The chart is used for calculations, involving numbers in the form $M \pm j1$ and $1 \pm jN$, where M and N are less than unity — for example, the number $1 \pm j0.5$.

To find the polar form, lay the straight edge from the origin to 0.5 on the right vertical N scale. The distance between these two points measured on the scale of the straight edge is 1.12 units and the angle measured on the degree scale is 26 deg. The polar form of the number is $1.12\angle\pm26°$.

To find the reciprocal of $1 \pm j0.5$, place the straight edge as described and find its intersection with the arc. The distance to this point from the origin is measured as 0.895 and the horizontal and vertical projections are 0.8 and 0.4, respectively. The reciprocal is then $0.8 \pm j0.4$ or $0.895\angle\pm 26°$. If the original number is $0.5 \pm j1$ the process is identical with that described except that it is now in the form $M \pm j1$. In this case the top horizontal scale is used, and the value 0.5 on the M scale and the origin determine the position of the straight edge.

Usually a complex number, $a \pm jb$, is not in a form which can be used with the chart. It can easily be converted to one of the chart forms by dividing both terms by the larger of the two. Thus, $a \pm jb$ becomes

$$a\left(1 \pm j\frac{b}{a}\right), \text{ when } a > b$$

or

$$b\left(\frac{a}{b} \pm j1\right), \text{ when } b > a$$

The terms in parentheses are recognized as the forms for which the chart is constructed. After using these terms with the chart, the results must be multiplied or divided by a or b, depending on whether a conversion or a reciprocal is being calculated.

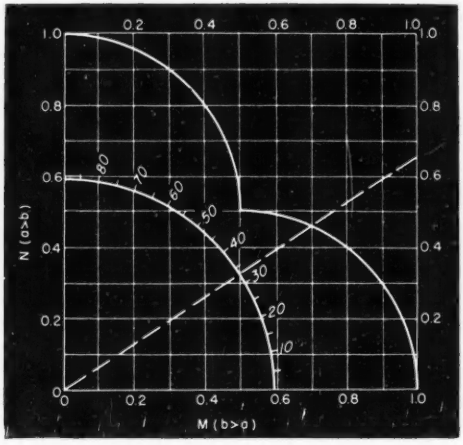
EXAMPLE

An example outlines the use of the chart and a slide rule. The slide is set only once. All results are obtained by moving the runner.

Let $4.20 + j2.78$ be either an impedance or an admittance.

Find (a) the polar form of the quantity and (b) its reciprocal in both rectangular and polar form.

Solution—The A and B scales of the slide-rule will be used. Since a>b, set 4.20 on the B scale under the left-hand index of the A scale. Keep this setting of the slide throughout the problem. Above 2.78 on the B scale read 0.665 on the A scale. Lay the straight edge on the chart from the origin to N = 0.665, indicated by a dotted line in the graph. The distance between these two points is 1.20 units and the angle 34 deg. Distance from the origin to the intercepted arc is 0.828 and the horizontal and vertical projections of this intersection are 0.690 and 0.460, respectively.



Using the slide rule:

(a) Under 1.20 on the A scale read 5.04 on the B scale. Then the polar form is:

$$4.2 + j2.78 = 5.04\angle+34°$$

(b) Above 0.690, 0.460 and 0.828 on the B scale read 0.164, 0.110 and 0.197 on the A scale. Then the reciprocal is:

$$\frac{1}{4.2 + j2.78} = 0.164 - j0.110 = 0.197\angle-34°$$

Conversion of a complex number from polar to rectangular form can also be performed. Let the number be $A\angle\pm\Theta$. Lay the straight edge through the origin marking an angle Θ with the horizontal. Let the distance from the origin to the horizontal or vertical scale be S and the intercept on these scale be either M or N, depending on which scale is intersected.

On the slide rule divide scalar A by S, and multiply this quotient by M or N. The rectangular form is then

$$(b) \qquad \frac{A}{S}M \pm j\frac{A}{S}, \text{ when } \Theta > 45°$$

or

$$(a) \qquad \frac{A}{S} \pm j\frac{A}{S}N, \text{ when } \Theta < 45°$$

If the reciprocal of $A\angle\pm\Theta$ in rectangular form is desired, place the straight edge as before. Let the horizontal and vertical projections of the intersection with the arc be x and y.

$$\frac{1}{A\angle\pm\Theta} = \frac{S}{A}(x \pm jy)$$

THE BEST TRANSFORMER FINISH NOW TESTS 50% BETTER

We agree with you—paint *is* important. It's often the only maintenance a good transformer will ever need.

So, it has been gratifying to have you tell us, for a decade now, that the finish on Spirakore* transformers is tops. However, unless you've seen a ***new*** Spirakore transformer, built in the last two years, you haven't seen the latest—and best!

We still shot blast, completely, every transformer tank. We still use zinc paint ***under*** all welded-on parts. We still use a rust-inhibiting primer. And to our synthetic Glyptal paint, which until two years ago beat anything we knew of, we've added a clear plastic-like material called melamine. Result: 50% increase in weather durability! 50% greater resistance to water absorption! 25% better color retention!

JUST ONE OF MANY IMPROVEMENTS

Today, as 10 years ago when lighter, smaller Spirakore transformers made history, Spirakore still leads the field. Besides better paint, you get Spirakore design in all single-phase ratings—for greater savings in size and weight. You get improved impulse strength. You get improved operating characteristics. You get sealed tank construction—which greatly prolongs oil life. And you get improved accessibility even with the complete sealing.

Yes, Spirakore is the finest distribution transformer we have ever made, the finest you can buy. Ask for Bulletins GEA-4885 and GEA-4521. *Apparatus Department, General Electric Co. Schenectady 5, New York.*

*Reg. U.S. Pat. Off.

Spirakore Transformers

GENERAL ELECTRIC

Construction Arrangement On Joint-Use Poles

Height limits and neutral space are indicated for power supply and communication attachments. Accompanying five cases are from methods of Central Maine Power Co

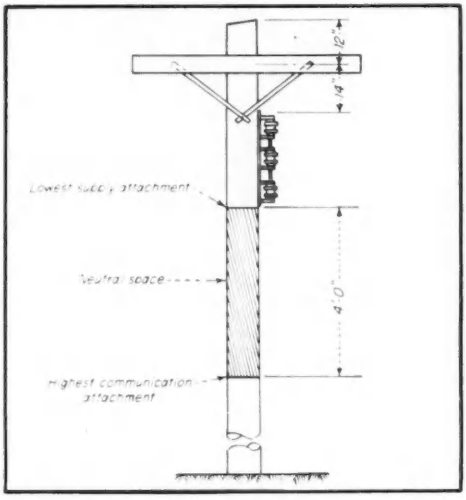


FIG 1—30 and 35-ft poles with crossarm and rack

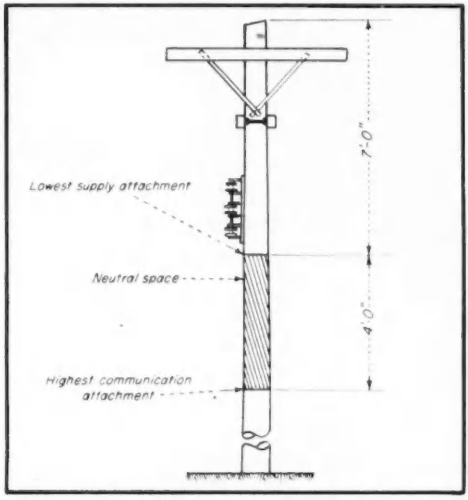


FIG 2—40-ft pole with crossarm and rack

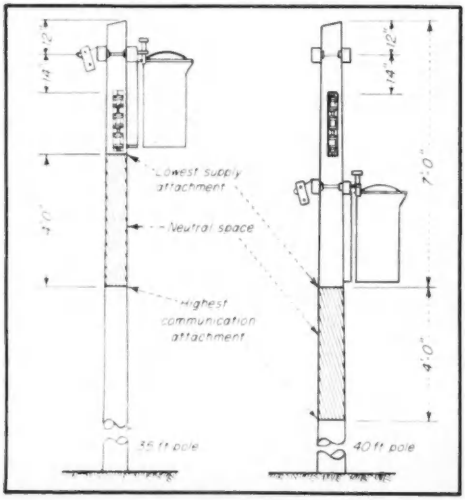


FIG 3—35 and 40-ft poles with transformer

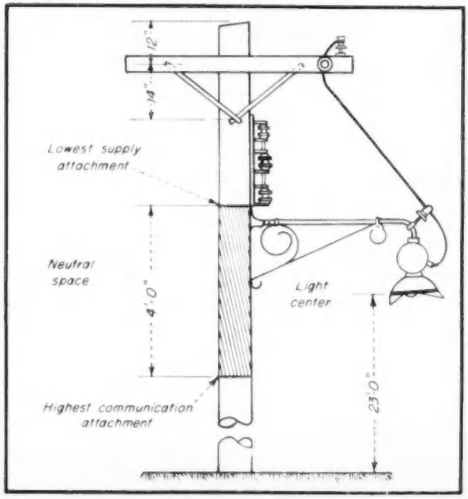
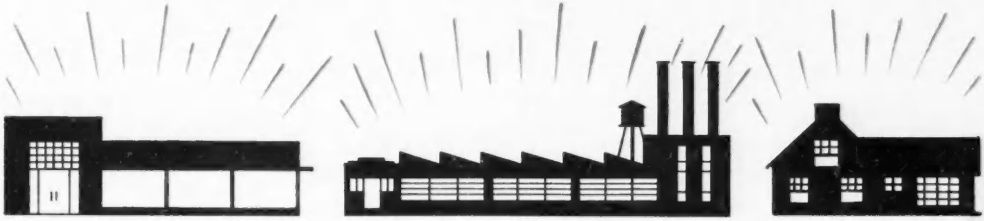


FIG 4—35-ft pole with street lamp and bracket

$21,000 CASH PRIZES OFFERED IN GENERAL ELECTRIC'S BIG PLANNED LIGHTING COMPETITION!



PLANNED LIGHTING
PRIZES FOR COMMERCIAL LIGHTING

PLANNED LIGHTING
PRIZES FOR INDUSTRIAL LIGHTING

PLANNED LIGHTING
PRIZES FOR HOME LIGHTING

Extra money for you in your Planned Lighting jobs! 192 separate prizes for:

Utility Lighting Representatives
Wholesaler's Salesmen Architects
Fixture Manufacturer's Salesmen
Electrical Contractors Retailers
Builders Lighting Consultants

IF you have a hand in planning, selling, supplying, or installing a 1949 General Electric Lamp Planned Lighting job, you're eligible for as much as $250 in cash prizes! There's a total of 36 awards—24 for commercial and industrial installations—12 for residential. Each award includes several $100 cash prizes for those cooperating in planning, selling and installing the lighting—192 cash prizes in all. In addition, the person sending in the report on the winning installation receives an *extra* $150.

You can enter both initial and relighting installations. Judging will be on the basis of how well the installation did the desired lighting job for the user.

SELECT YOUR ENTRIES NOW

Every Planned Lighting job has a chance to win. All entries in this competition must be in the mail no later than January 31, 1950, so get your planned lighting installations under way. If you don't already have the complete rules for the General Electric Planned Lighting Awards, call your local General Electric Lamp Department office.

CHECK THESE NEWEST G-E SALES HELPS!

Here are four of the latest Planned Lighting sales tools from General Electric. Make sure you use them all. They're available through your General Electric Lamp District office.

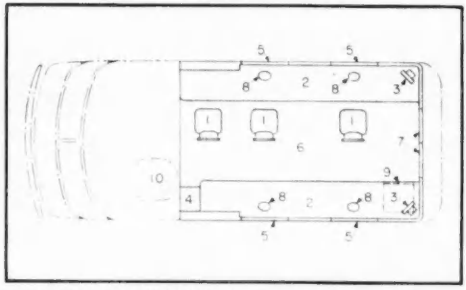
1. **"THE LIGHT IN YOUR LIFE"**—a fast-moving, full color movie on lamps and lighting.
2. **PLANNED LIGHTING GUIDEPOSTS**—a complete selling manual.
3. **"THE GREENHOUSE"**—a Kodachrome sound-slide film on the latest ideas on home lighting.
4. **"LIGHTING EQUIPMENT MERCHANDISERS"**—a 56 page guide to increased selling at the point-of-sale.

GE LAMPS

GENERAL ELECTRIC

Mobile Cashier Truck Serves 21 Communities

MOBILE CASHIER UNIT provides "curb service" for customers paying utility bills. In actual use, cashier windows are opened only on the sidewalk side. Aluminum awning carries poster on upper side



INTERIOR ARRANGEMENT of mobile unit equipment includes: 1–Stool, 2–counter desk, 3–fan, 4–heater, 5–window, 6–linolcum flooring, 7–door, 8–dome light, 9–safe, and 10–driver's seat

A MOBILE CASHIER unit with a minimum staff of two cashiers is the latest addition to the vehicular fleet of Consolidated Edison Co of New York, Inc. At this unit, residents in 21 Queens communities can pay their utility bills. Stops are scheduled once a month at specified locations. Time and expense can be saved by those customers remote from district offices.

This cashier's truck consists of a standard Chevrolet forward control chassis equipped with a Grumman aluminum alloy Kurb-Side body. Exterior of the truck is colored red and white with grey paneling. Two cashier-type windows are installed on each side so that the truck can operate on either side of the street. A wide aluminum panel, faced with a promotional poster, covers the windows on each side while the unit is in transit. On location, the windows facing the sidewalk are exposed by raising this panel, which provides an awning effect over the windows.

Full-length Desks

Interior office space, located to the rear of the driver, provides an area 128 in. wide and 70 in. high. Counter-desks extend the full length of each side wall, with seating space at each window, and include the necessary storage space and cash drawers to meet the requirements of each cashier. Three movable cashier stools are held stationary by straps when truck is in motion.

Standard cashier's working equipment includes a safe, two coin change machines, two adding machines and a portable typewriter.

Ventilation is supplied by two fans. A compact heating unit is ready for use during cold weather. Roof and both sides are fully insulated and the smooth plate floor is covered with linoleum. Four dome lights provide interior illumination.

A Pragmatic Approach to Reasonable Rate of Return

(Continued from page 86)

tions of its capitalization must be on a 9% basis, the end result would be to take the difference away from earnings available to its present common stockholders. Putting it another way, to raise the additional capital the company would have to sell a number of shares of common stock which would be disproportionately greater than the increase in earnings available for the common stock.

Earnings Become Diluted

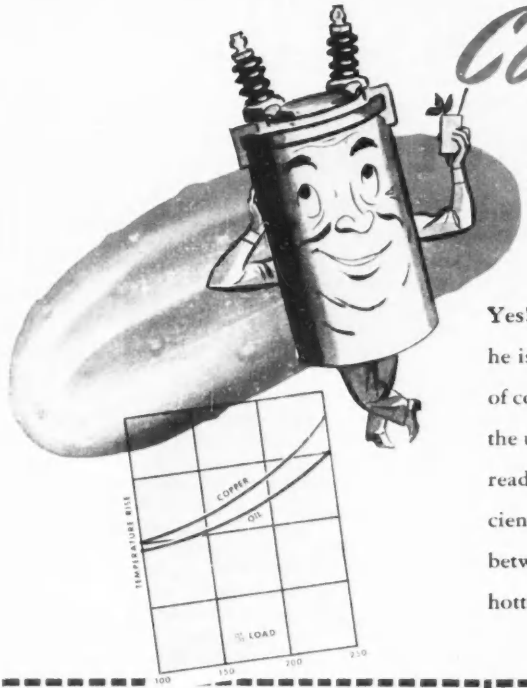
Obviously, whenever the percentage increase in number of shares outstanding is greater than the prospective increase in earnings, the earnings equity (per share interest in earnings) of present stockholders is diluted.

Under the conditions above posted, this would mean that, in effect, the officers and directors of a company would be taking some of the present earnings away from some of the present stockholders, in order to meet the market requirements of the earnings necessary to support the sale of a sufficient amount of additional common stock to raise the necessary additional equity money. No management, in the writer's judgment, should, by reason of inadequate rate of return, be put in the position of having only two alternatives: first, diluting present stockholders' equity; or, second, abandoning the construction necessary for adequate service, because of inability to finance that construction program without diluting present stockholders' equity.

Responsibility of Management

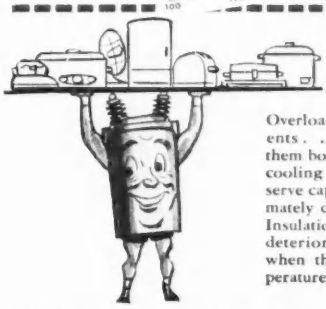
Moreover, modern legal thinking is to the effect that the officers and directors of a publicly-held corporation have fiduciary responsibilities to the security holders of that corporation. As trustees of public funds invested in the corporation, any management and board of directors would find it difficult to sustain the contention that they were observing

Cool as a CUCUMBER!



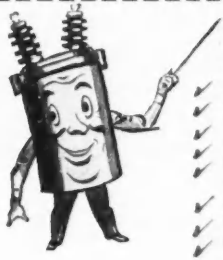
Yes! "Hi" HiperCore is cool as a cucumber, because he is designed to be cool. He is made with a core of cold-rolled, oriented silicon steel which permits the use of a smaller, narrower, and therefore more readily cooled coil. His numerous and more efficient cooling ducts provide greater contact area between the winding and the oil resulting in lower hottest-spot-over-oil temperature.

ME49-20



Overloads or High Ambients . . HiperCores take them both in stride. Better cooling means greater reserve capacity for that ultimately certain emergency. Insulation materials in oil deteriorate more slowly when the operating temperature is reduced.

HiperCore Transformers will provide longer, trouble-free service than older style transformers. HiperCores have a longer life expectancy, thanks to advanced Surge-Tested Design and the use of a high factor-of-safety in the application of the insulating materials.



CHECK HIPERCORE PLUS FEATURES!

- Lower Hottest-Spot-Over-Oil Temperature
- Longer Operating Life
- High Factor-of-Safety in Design
- Lighter Weight
- Smaller Size
- Greater Short-Time Overload Capacity
- Better Voltage Regulation
- Superior Tap Changer

HiperCore

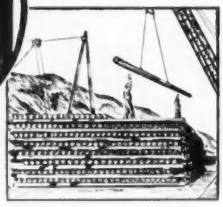
Photo shows 5 Kva, 7200 to 120/240 volts Conventional Type HiperCore Transformer. HiperCore Transformers range in size from 3 Kva to 50 Kva inclusive. Write for Bulletin H-303 for complete information about HiperCore Transformers.

MOLONEY ELECTRIC COMPANY

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONTARIO, CANADA

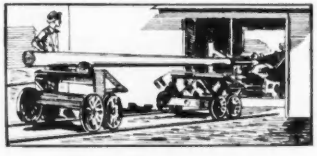
BAXCO LONG-LIFE DOUGLAS FIR PRESSURE TREATED LONG POLES

For over 50 years J. H. Baxter & Co. with its Associated Pacific Coast Companies has specialized in the production and sale of exceptionally long (up to 125 feet) Wood Poles for the electric power, lighting and telephone utilities . . . Stocks in all lengths are complete — shipments prompt!



PROPER SEASONING

BAXCO poles are carefully seasoned in dry, clean yards. Proper pre-conditioning before Pressure Treatment adds years of longer life.

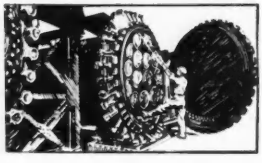


MACHINE SHAVING

To produce smoother and more uniform poles, the BAXCO process includes machine shaving. This removes small swells and results in a more round, evenly tapered product.

PRESSURE TREATMENT

Deep penetration and high retention of the preservative is a hallmark of the BAXCO Pressure Treatment Method.



Get the Full Story! Write today for this BAXCO BOOKLET

J.H.Baxter & Co.

333 MONTGOMERY STREET · SAN FRANCISCO 4, CALIFORNIA

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the fiduciary relationship, under conditions in which they committed the funds of the corporation in fixed assets at a prospective rate of return which they know is less than that which the market indicates is required—if they knew it. Such a course of action could have only one end result: The dilution of the equity of present stockholders. And such a course of action, taken with previous knowledge, would certainly seem to be a breach of fiduciary responsibility.

Other Effects

It should be pointed out, incidentally, that a lower than investor-required composite rate of return might also affect the company's ability to sell additional bonds at present yields for its debt. This is because the lower rate of return would not result in a maintenance of "times interest earned".

One other factor should be emphasized. To the extent that a company finances part of its construction program by retaining earnings, it is, in effect, putting money which belongs to its stockholders back into property. If it puts these earnings back into property on a rate of return basis worse than the required rate of return indicated by the composite yield on its securities, it is obviously doing the stockholders a distinct disservice. It is, in effect, requiring (negatively) to invest their funds on a basis that the stockholders would not invest their funds, given free choice, as evidenced by the earnings yield basis on which the common stock sells. This is also true with respect to the reinvestment of annual depreciation accrual.

Commissions Must Cooperate

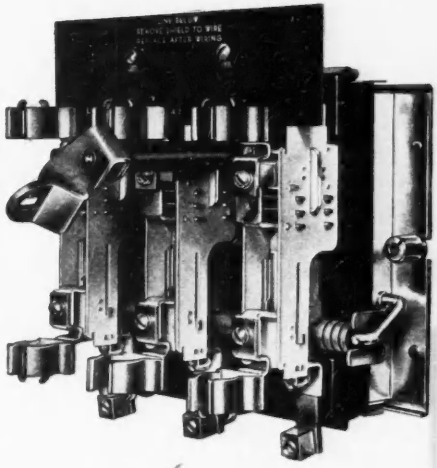
If the writer is correct, Citizens Utilities Co. for example, must have the cooperation of the commissions under which it operates in fixing rates for its services, which rates will provide a rate of return of approximately 9% on capital employed. This is the "cold, bloodless verdict of the market place", as to the rate of return investors require on the composite securities of Citizens, if Citizens is to succeed in raising the capital required to carry out its basic program of providing more and more consumers with a greater amount of utility commodities at the lowest possible cost. It would also

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

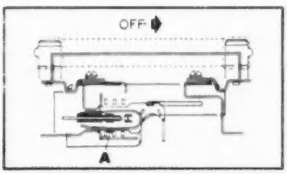
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

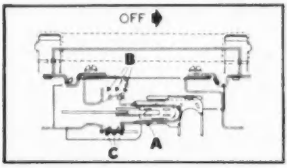
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.



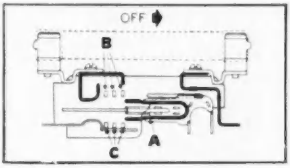
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Red indicates current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

Underwriters' approval throughout.

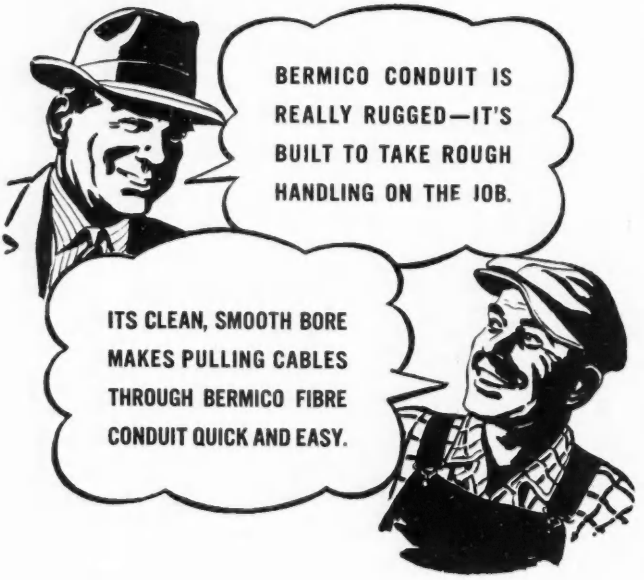
For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

BERMICO* FIBRE CONDUIT


BERMICO CONDUIT IS REALLY RUGGED—IT'S BUILT TO TAKE ROUGH HANDLING ON THE JOB.
ITS CLEAN, SMOOTH BORE MAKES PULLING CABLES THROUGH BERMICO FIBRE CONDUIT QUICK AND EASY.

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follow that each company must similarly have the cooperation of a commission or commissions in the establishment of rates which will provide a rate of return on capital employed equal to the rate of return *required* by investors for that individual company.

Under the above contentions, it therefore follows that an approach to the question of "fair" or "reasonable" rate of return along these lines by regulatory agencies and the courts would take the question of what is "fair" or "reasonable" rate of return out of the speculative or subjective sphere and place it in the proper milieu. Such procedure will enable both regulatory commissions and courts to calculate "fair" or "reasonable" rate of return with respect to any individual company in a realistic manner based on finite evidence.

Frequent Review of Return

It is recognized that this suggested approach to the question would indicate that there ought to be reasonably frequent review by both companies and commissions of what the investing public is saying is a required rate of return for any individual company. It would also follow that in just these terms there would be a need for reasonably frequent revision of rates, upward or downward, to bring the rate of return actually being realized by a company to a level which investors indicate is the return which they require.

For some utility companies in prime investor classification, this might mean reduction in earnings, brought about by reduction in rates. For many companies in secondary classifications, so far as investors are concerned, such a review would emphasize the need for increased rates and earnings. But if the purpose of regulation is equitably to treat with *both* the consumer and the investor—and this is the philosophy which all regulatory bodies and the courts enunciate—frequent review and adjustment to the realities is indicated as the only solution which can be classified as equitable.

Rate of Return Varies

Over a period of recent years, the required rate of return for Citizens Utilities Co. for example, has varied considerably. For the year ending

(*Continued on page* 115)

ARE *Your* CITY DISTRIBUTION LINES READY FOR STEPPING UP TO NECESSARY HIGHER VOLTAGES?

"The day of 2,300-volt city distribution is approaching an end in most localities," is a statement commonly being made by forward-looking power executives. Higher voltages are becoming general, today, as a means for meeting the mounting residential and industrial load.

Many voltage increases can be made economically without loss of fixed investment in conductor or transformers, merely by reconnection. Capacity of distribution circuits is thus stepped up in the order of three times. Line insulation, as a part of this fixed plant, will probably continue to serve, but deadends built only for 2,300-volt operation are generally inadequate. Modern deadend practice for higher voltage city distribution circuits involves the use of six-inch suspension units.

Whether a voltage increase is immediately planned or is still a consideration for the future, much time and expense can be saved by building all present primary deadends with the correct suspension unit, thus avoiding later revision in the crowded area of pole tops. When this is done as a foresighted move, the system is then ready to be cut over conveniently and economically, and in the meantime, distribution circuits will benefit by the best and safest deadend practice.

And when you build these suspension-type deadends, use the most respected insulator in the industry—O-B. Six-inch O-B units have the same tradition of strength and durability as the larger sizes used in high voltage construction. They're thoroughbreds!

HI-TENSION NEWS *Junior*

Ohio Brass

MANSFIELD, OHIO, U. S. A.

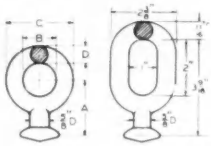
Distributed by GrybaR

Here's a place to get some IDEAS

It's like a gold mine for the ingenious engineer or construction man to find just the thing he was looking for. These miscellaneous O-B hardware items were all designed for specific jobs, yet it is amazing how they turn up in unexpected places—"the answer to a prayer." Maybe you'll put them to work as they were intended. Maybe you'll improvise. Maybe, possibly, you've forgotten about a few even though they are all in the Catalog. In any case, we are marching them before you on review. The products are all O-B. The ideas are all yours. Go to it . . .

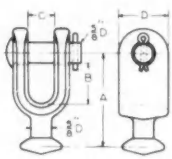
Ohio Brass

MANSFIELD, OHIO, U. S. A.



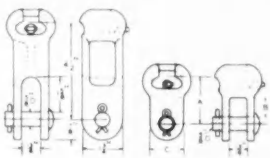
BALL EYES

For attaching ball and socket type suspension insulators to supporting structures. On the smaller piece, dimension (C) varies from $1\frac{11}{16}$ to $2\frac{5}{8}$ inches; other dimensions in proportion.



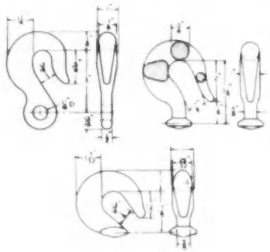
BALL CLEVISES

This is a third type of ball and socket suspension insulator support. Dimension (A) varies from $2\frac{3}{4}$ to $3\frac{3}{4}$ inches.



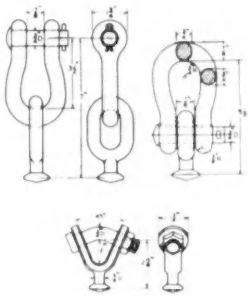
SOCKET CLEVISES

An intermediate fitting used to make connections between ball fittings and those with drilled tongues or eyes. Dimension (A) varies from $2\frac{1}{8}$ to $4\frac{1}{2}$ inches.



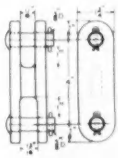
HOOKS

Another connection between ball and socket suspension insulators and supporting structures. The small, close-coupled design is first attached to the support and is then connected to the insulator. When this is done, the insulator cap closes the opening of the hook and prevents release by accidental uplift.



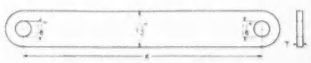
TOWER FITTINGS

Considerable selection is available in this class of fitting for the support of ball and socket type suspension insulators.



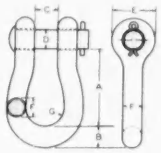
CLEVIS CLEVISES

A double-clevis spacer to fit drilled tongues or eyes.



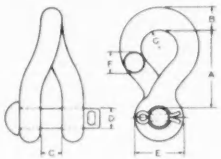
EXTENSION STRAPS

Serve the same purpose as Extension Links in lighter service. Dimension (X) varies from 4 to 18 inches.



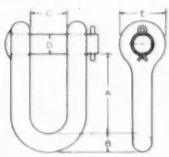
ANCHOR SHACKLES

Another basic style of clevis type suspension insulator attachment. The pin may be replaced by a threaded bolt and nut on order. Dimension (A) varies from 1⅞ to 3⅝ inches. Strengths go as high as 75,000 pounds.



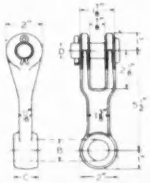
TWISTED SHACKLES

Similar to Anchor Shackles except for a 90-degree rotation of the pin in relation to the structure. Bolts may replace this pin. Dimension (A) varies from 2¼ to 2⅞ inches.



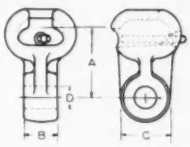
CHAIN SHACKLES

A further variation on the shackle design. Threaded bolts are also available. Dimension (A) varies from 1¾ to 4⅜ inches.



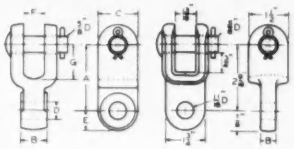
CLEVIS EYE CONNECTORS

Made especially for attaching ALCOA compression deadends to suspension insulator yokes and other fittings. Dimension (B) varies from 1⅜16 to 1⅝16 inches.



SOCKET EYES

A very popular item used for attaching conductor hardware to the lower end of a ball and socket suspension string. Seventeen styles are adapted to various clamp dimensions.



CLEVIS EYES

For attaching conductor hardware to the lower end of a clevis type suspension string. Likewise available in 17 styles to fit a variety of clamps.

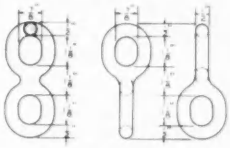
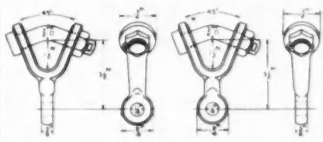


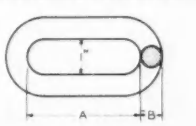
FIGURE-8 LINKS

Made in both straight and rotated styles.



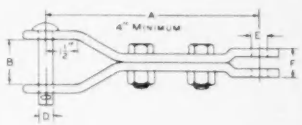
"Y" CLEVIS EYES

For attaching clevis type suspension insulators to supporting structures.



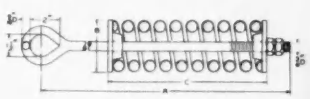
CHAIN LINKS

A handy connector or spacer for many uses. Dimension (A) varies from 2¼ to 3¼ inches; (B) from ½ to ¾ inch.



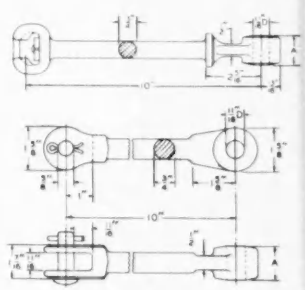
CLEVIS TONGUES

Dimensions (A, B, D, E, and F) are subject to specification for any job which may develop. With such flexibility, this piece can find many applications.



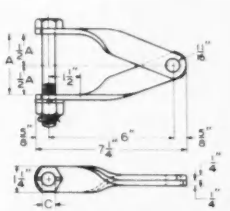
SPRING BOLTS

Two types provide tensions up to 2,000 or 5,000 pounds. Dimension (A) is 16 inches on both models. Other dimensions ruled by size of spring.



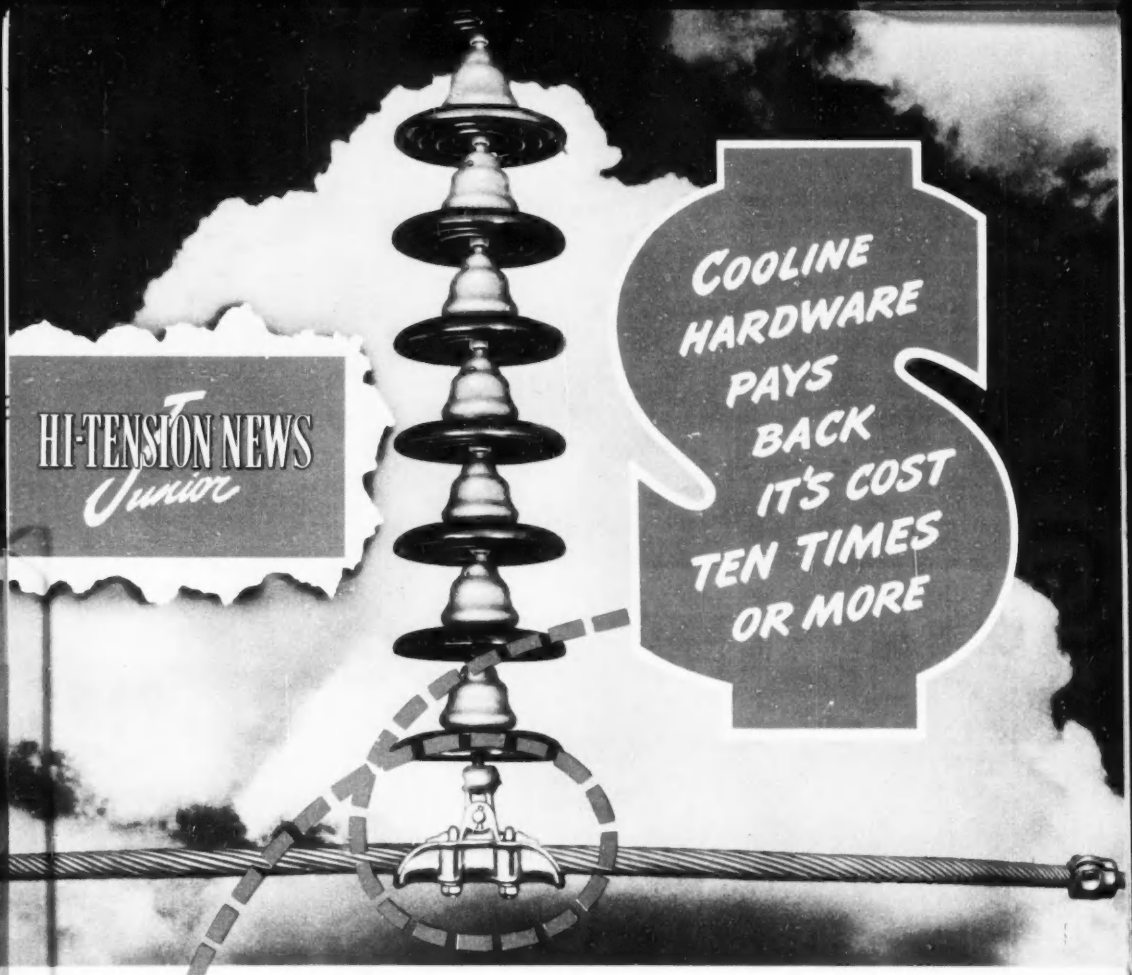
EXTENSION LINKS

As their name implies, these are a handy, strong spacing member of double clevis type, or ball and clevis at either end.



DEADENDING STRAPS

For attaching suspension insulators to a steel member or channel type crossarm at deadend points. Dimension (A) varies from 3 to 8 inches.



On transmission lines, especially those with phase currents above 200 amperes where power losses are most pronounced, the power savings of O-B Cooline non-magnetic hardware will probably pay you back in cash ten times or more its total cost during the life of the line.

Another saving—generation equipment that costs real money per kw capacity is not partly wasted in producing current merely to heat line hardware. Cooline hardware does not heat. The facilities thus conserved will produce power for sale at the meter. Many thousands of dollars in capital investment are involved in this class of saving.

Your purchase of O-B Cooline non-magnetic hardware will return many times its cost in tangible terms, with a bonus of conductor preservation since there is little electrolytic action between the two similar metals.

Specify the most modern hardware—O-B Cooline—on your next transmission line project.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

2978-H

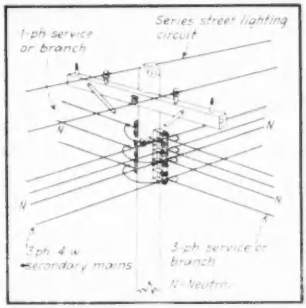
Pragmatic Approach to Rate of Return

(Continued from page 110)

December 31, 1944, it was 6.81%; for the year 1945, 6.23%; for 1946, 5.66%; and for 1947, 7.96%; and as indicated by the data which the writer has gone over at some length, for the year 1948 it was 9.44%.

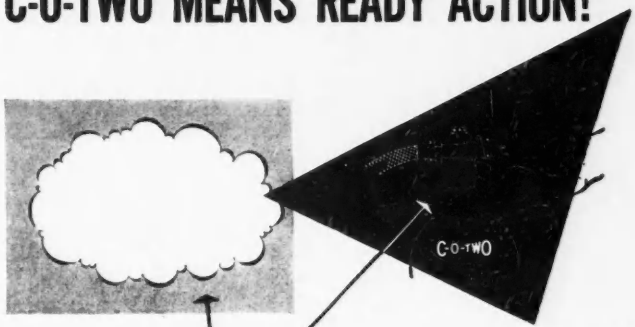
For every other company which is publicly owned, it can reasonably be presumed that there has been variation in at least equal amount. But it is not the variation which is important, nor is it the history. What is important is, as of a proximate date, what investors require of a company, if the company is to succeed in obtaining additional capital from them. For each company this will differ; and for all companies "fair" or "reasonable" rate of return, when it is more accurately and realistically defined as investor-required rate of return, will change from time to time. The very reality of these facts, and the very reality that "fair" or "reasonable" rate of return as defined in these terms can be finitely measured from time to time, supports the contention that this pragmatic approach, to what heretofore has been a subjective and esoteric percentage, should be widely adopted.

Safe Positioning of Delta Secondaries



TO INSURE safer line work, Hartford Electric Light Co has established fixed locations for 3-ph delta secondaries as shown. Series street lighting wires are carried on the top cross-arm next to the pole. The neutral is always the middle wire in secondaries, racked below. Live legs of the main transformer (transformer having neutral center tap) are always the top and bottom wires. The remaining live leg is always the second wire from the top. 3-w, 1-ph services or branches are taken from the top and bottom live legs

C-O-TWO MEANS READY ACTION!



CARBON DIOXIDE + SQUEEZ-GRIP* VALVE

you get QUICK, POSITIVE fire protection

When you release carbon dioxide from a C-O-TWO* Squeez-Grip* Portable Fire Extinguisher . . . just squeeze lever to open . . . release to close. The Squeez-Grip* Valve operates as fast as you can open and close your hand . . . the greatest single contribution to the releasing of carbon dioxide from portable fire extinguishers.

C-O-TWO* is carbon dioxide . . . kills fire in seconds . . . harmless to materials and equipment, even food. It is clean, dry and odorless . . . non-deteriorating and non-conducting . . . highly effective on flammable liquid and electrical fires . . . leaves no after fire mess.

C-O-TWO* makes a complete line of fire protection equipment . . . carbon dioxide hand and wheeled portable fire extinguishers, carbon dioxide hose rack and hose reel fire extinguishing units, built-in carbon dioxide fire extinguishing systems and built-in smoke and heat detecting systems . . . approved by Underwriters' Laboratories, Inc., Factory Mutuals and Government Bureaus.

Let an expert C-O-TWO* Fire Protection Engineer help you in planning complete up-to-date fire detecting and extinguishing facilities for your property now, before fire strikes. Write us today for complete information.

*T. M. REG. U. S. PAT. OFF.

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1, • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

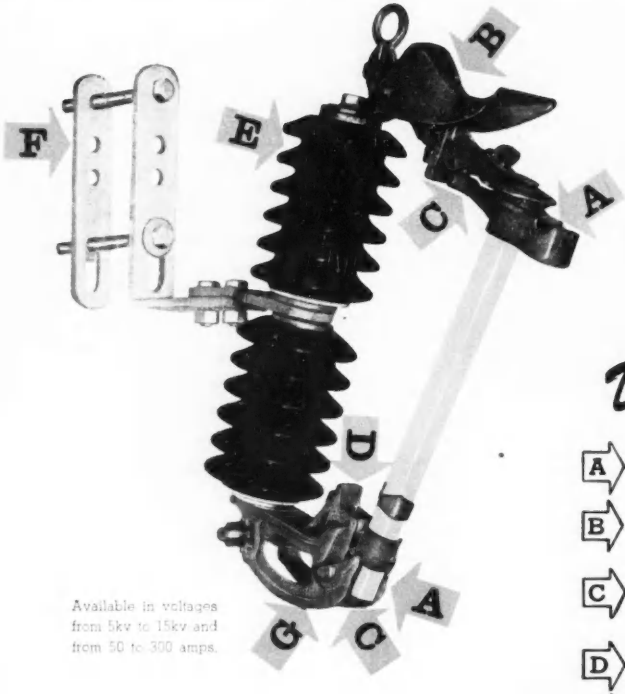
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

DEPENDABLE

. . Plus Coordination, in Two Southern States Products

Now you can assure **your** installation of double protection! Southern States outstanding Fuse Link, for **dependable** coordination, in Southern States famous Type 33 Dropout Cutout, for **dependable** protection!

Immediate Deliveries from factory stock or from your nearest distributor.



Available in voltages from 5kv to 15kv and from 50 to 300 amps.

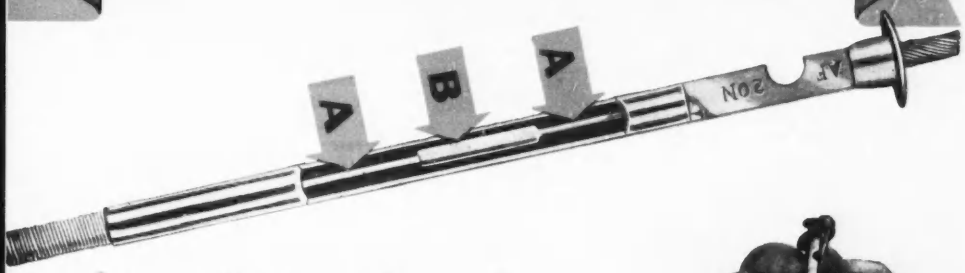
Positive semaphore! The tube drops to an inverted position when link is blown. It is quickly and easily removed and replacement installed with hook stick.

SS

Type 33 Dropout CUTOUTS

- **A** — Double vented tube provides higher interrupting capacity and prevents "shotgun kick" with destructive shock to equipment.
- **B** — Sleet-shield top latch provides dependable operation under all weather conditions.
- **C** — Positive dropout action is assured by knee-action mechanism at top and bottom of tube assembly.
- **D** — Dependable operation at full rated current is assured by evenly distributed pressure and full wiping action of solid copper contacts.
- **E** — Insulator replacement costs are lower with Southern States two-piece insulator units
- **F** — Universal mounting bracket provides either cross-arm or pole mounting.
- **G** — Self-locking hinge prevents tube falling out on down swing.

PROTECTION



A. **Copper Alloy Element.** Burns under heavy fault. Joined in ferrule with—

B. **Low Temperature Melting Alloy.** Melts under overload.

For over 15 years, operating engineers have relied on Southern States **soldered element fuses** for protection against both high current faults and low current overloads.

Through the use of a solder alloy located in the center of the link, Southern States fuse links provide highly reliable protection against low overloads. This soldered joint is **not** simply a construction feature, but it is a distinct element in the establishment of the desired Time-Current Curve.

Southern States fuses are available in three speeds, providing greater flexibility for co-ordinating with breakers or other fuses. All NEMA "N," 100% Rated Links, these fuses are available in the universal type, adaptable to practically all expulsion fuse holders.

Now Southern States fuse links come to you in a waterproof, easy-to-handle, plainly marked container. Packed five to a box, each has its own compartment.

Southern States Equipment Corp.

HAMPTON GEORGIA

Representatives in:

BIRMINGHAM, ALA.	CHICAGO, ILL.	KANSAS CITY, MO.	DALLAS, TEX.
LOS ANGELES, CALIF.	EVANSVILLE, IND.	ST. LOUIS, MO.	EL PASO, TEX.
SAN FRANCISCO, CALIF.	VALPARAISO, IND.	NEW YORK, N. Y.	HOUSTON, TEX.
DENVER, COLO.	LOUISVILLE, KY.	CHARLOTTE, N. C.	LUBBOCK, TEX.
WASHINGTON, D. C.	NEW ORLEANS, LA.	PHILADELPHIA, PA.	SALT LAKE CITY, UTAH
JACKSONVILLE, FLA.	SHREVEPORT, LA.	CHARLESTON, S. C.	SEATTLE, WASH.
MIAMI, FLA.	BOSTON, MASS.	KNOXVILLE, TENN.	MILWAUKEE, WISC.
ATLANTA, GA.	JACKSON, MICH.	MEMPHIS, TENN.	

LOAD BUILDING

Fluorescents Increase Incomes of Tobacco Growers

BETTER GRADED tobacco brings better price. Utility takes demonstration to the farm

AGRICULTURE ENGINEERS and rural representatives of Appalachian Electric Power Co are showing tobacco farmers how they can add $13,000,000 to the value of their annual crop by the use of electricity. At least $7,000,000 alone will be gained by the use of fluorescent lighting in the grading of tobacco. The remainder will come from proper irrigation and the growing of plants in electrically heated hot beds centrally located to supply many farmers.

The utility has set up a four-step long-range program which is broken down into (1) improvement of grading; (2) better and hardier plants free from disease grown in centrally located plant beds with use of electric soil heating and sterilization; (3) supplemental irrigation to increase quality and yield; and (4) better curing practices using knowledge gained in hay drying.

Program Is Being Expanded

Step 1 has already been successful and is being expanded throughout the territory. The remainder of the program is being put into effect as rapidly as possible, according to L. L. Koontz, system rural supervisor. Mr. Koontz said that in 1948 Virginia and West Virginia produced 143,433,000 lb of tobacco valued at $70,475,000. Moneywise it is the second most important agricultural crop in Virginia.

Profits Are Stressed

To get the story over to the tobacco growers, the power company staged grading demonstrations with the fluorescent lighting units. Window displays attracted additional attention. Increasing profits to growers from installations so far made are now becoming a potent sales force.

Co-operative Challanges LP Competition

"WHICH will you choose (LP gas or electricity)? For, make no mistake, a choice will have to be made. As a group, we cannot have both. Concentrate our resources to provide one type of utility, and we can each make use of this electric service at reasonable cost. Divide our resources to provide a second utility where one would do, and we make the electric service needlessly costly to all, costly beyond reach to some. It is that simple."

Progress of Electricity

In the above forthright terms Glenn B. Snapp puts the problem of LP competition up to the members of the NCK Electric Co-operative, Inc, Belleville, Kansas. In a special edition of *OHM News* published by the co-operative for its members, Mr. Snapp tells the "Story of a Revolution in Our Time", how electric service has lightened farm and farm home labor and has brought the amenities of modern living to country folks. Extension of these benefits and continuing enjoyment of them at reasonable cost are now being threatened by the inroads of competition. Mr. Snapp concludes his recital with the following words:

"By working together, we established this organization and by continuing to work together we can make it succeed. But if some of us are going to pull off on our own, with a "to-heck-with-the-rest," and for a few nickels of doubtful and unproved personal gain, succumb to the wiles of every Low Pressure salesman, and fall for every Low Pressure sales sheet that comes our way, and thus force us all to a higher minimum or over-all higher rates, what becomes of those doubtful gains?

Expansion Is Blocked

"Some of our expansion plans are now being held up in Washington, because the REA does not think these plans will pay out. Moreover, neither our older members who are now pay-

Longer Life

WITH JOSLYN URC POLE LINE HARDWARE

Extend the Life Span of your pole lines by using Pole Line Hardware made of low alloy high strength steel. This steel will resist atmospheric corrosion four to six times longer than carbon steel and, with the additional protection of Joslyn galvanizing, the expected life of pole line hardware is at least doubled—and this at a negligible increase in cost. Costs of Pole Line Hardware made of URC are only approximately one-third greater than standard structural material—a cheap price to pay for double the life. In addition to this, URC hardware is stronger, with a minimum yield strength 50% greater than that of regular steel.

If you are in an area where this happens to your hardware before the ultimate life of the rest of the line has been reached—better consider Joslyn URC Hardware.

Write for new catalog of Long Life Pole Line Hardware.

Branch offices in principal cities

•

THE JOSLYN CO.
THE SOUTH EAST-JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

JOSLYN MFG. AND SUPPLY CO.

Complete Pole Line Equipment

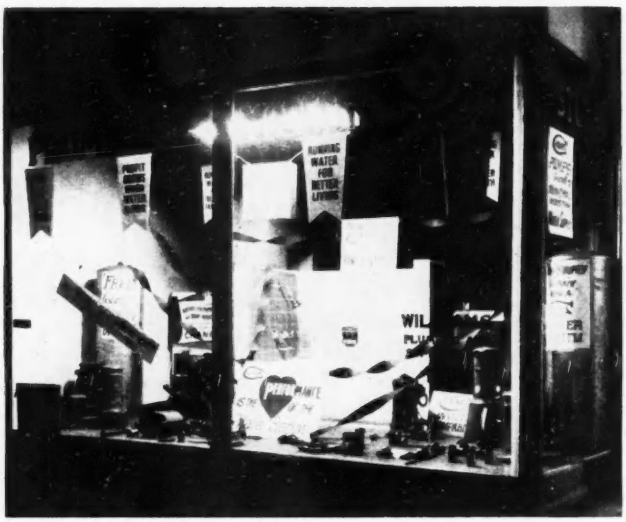
20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

ing adequate monthly bills, nor our prospective consumers who plan to make real use of their electric service, are going to stand idly by and allow this whole movement to be placed in jeopardy, or made needlessly costly to them by our extending service to new customers who do not contemplate paying their full share, or continuing service to old consumers at less than equitable cost. A way will be found to adjust these costs between new and old customers.

"All these new boons to rural living that I have outlined in the preceding pages are now available to our farm people as a group, and with one installation, at a cost within the reach of all. There is another type of utility, by which three of these services can be had, cooking, refrigeration and water heating, a pitiful fraction of the total, and yet with about the same overall cost of installation. Which will you choose?

"Rural electrification has had many handicaps thrown its way, and has continued to thrive and expand, as one of the major movements of our time. I have every confidence that one more flea bite will not hurt it much. This is because I have confidence in the loyalty and good judgment and foresight-beyond-the-end-of-their-noses of the great majority of our farm people."

Dealers and Utility Unite to Sell Water Systems



WINDOW DISPLAY sold water systems for Williams Plumbing and Supply Co

R. T. JONES
Manager, Farm Sales
Pennsylvania Power & Light Co
Allentown, Pa.

IN MAY, this year, 990 electric water systems were sold by dealers in Pennsylvania Power & Light Co service territory. They worked on a direct mail prospect list of some 4,000 names furnished by the company. May was designated "National Water Systems Month" by the National Association of Domestic and Farm Pump Manufacturers. The dealers' efforts thus were backed up by national and regional promotion of pump makers and distributors as well as by company activities.

PP&L participation in this special emphasis period was in encouragement of, and co-operation with, local dealers to enable them to get utmost benefit from the many sales tools available from makers and distributors of water systems.

PP&L Supplies Promotion

The company serves 140,000 rural customers, 40,000 of them on farms scattered over 9,300 sq miles. To help the dealers in this market, the company furnished scripts for local radio broadcasts, advertised water systems in 50 weekly newspapers and supplied publicity copy, supplied prospect lists to dealers, sent its representatives to call on approximately 2,500 prospects, put dealer displays in company offices and arranged for them in local banks, arranged group meetings and movie showings, and made itself generally useful in various other ways.

Additionally, PP&L offered a CLM floor lamp as prize to the dealer in each company division doing the best sales job. Each dealer was assigned a sales quota for the month—20% of his total sales of water systems in 1948, in no case less than 5. The prize was awarded to the dealer whose sales were the highest percent of quota.

Campaign Preparations

In preparation for the May campaign, PP&L farm representatives called on water system dealers to get them steamed up, give them prospect lists, and urge them to use direct mail material, pennants, window streamers and placards supplied by manufacturers. How well they responded is shown by the accompanying picture of a typical dealer's window.

Sell Electric Service Through the Window

IF you use window envelopes, why not sell through the window? Not many utility customers have secretaries to open their mail; anyway, secretaries are prospects too. When the letter, or the bill probably, is pulled out, there it is, "Cook Electrically—Fast—Clean—Low Cost," or whatever you elect to use

ROCKBESTOS ANNOUNCES

VARNISHED CAMBRIC CABLE

an addition to our line to give you better service

Rockbestos VC cables are manufactured by men with the "know-how" gained from 23 years experience with varnished cambric tapes for high temperature operation on AVC cables.

Insure trouble-free operation and long life of your VC cables. Specify VARNISHED CAMBRIC CABLES by Rockbestos.

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH
ST. LOUIS LOS ANGELES OAKLAND, CALIF.

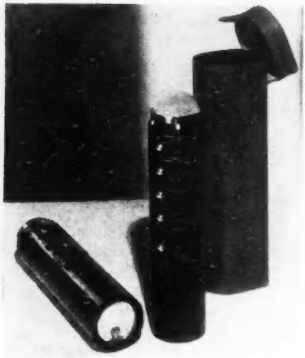
Planned and made to fit *your* needs best, Rockbestos Varnished Cambric Cable is available in every size you require. Write today for specifications and prices.

WIRES and CABLES by

ROCKBESTOS

. . . . . *dare to be better*

NEW EQUIPMENT



Sound Level Meter

FOR MEASUREMENT OF noise levels in and around power stations, Type 410-A sound level meter is manufactured by Herman Hosmer Scott, Inc, 385 Putman Ave, Cambridge, Mass. Small size and simplified controls enable anyone to use it.

This meter covers the range from 34 to 140 db. It is powered by hearing-aid batteries having a normal operating life of 50 hr. It has a two-speed meter and provision for optional types of microphones, vibration pickups and analyzers or filters. Unit is 11½ in. long, 2½ in. in diam. and weighs about 2 lb, including batteries. Bulletin EW contains further information.

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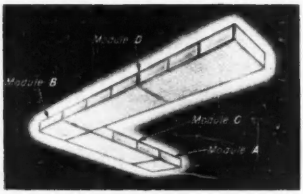


Modular Lighting System

MAKING POSSIBLE numerous pattern designs to custom-fit any room shape or proportions, a modular lighting system has been announced by Mitchell Mfg Co, 2525 Clybourne St, Chicago. Module system (see illustration) consists of four modules or units—Module *A* uses four 14-w, 15-in. lamps; module *B* mounts one 32-w Circline lamp and one side prong spot or flood lamp; four 40-w, 48-in. lamps are mounted in module *C*; and four 75-w, T-12, 425-ma Slimline lamps are used in module *D*.

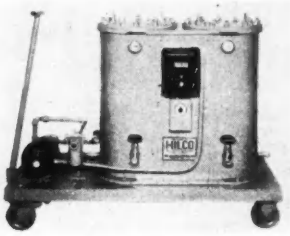
All units have a single or multiple standard measurement of 16¼ in. It is claimed that equal low brightness is produced on all sides and ends with no dark spots, regardless of lighting pattern.

•

Portable Oil Filter

LUBRICATING OIL in diesel engines and other machinery can be filtered on the spot in model FA-2X portable oil filter manufactured by Hilliard Corp, 102 W. Fourth St, Elmira, N. Y.

Filter assembly contains one or more



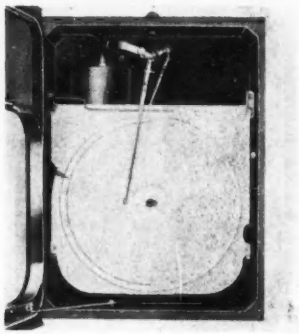
filter cartridges and is available with or without electric heaters. Cartridges can be packed to handle straight-run mineral oils and heavy-duty or compounded oils. Capacity of from ½ to 4 gpm is provided by ¼-hp motor-driven pump. Two lengths of oil-resisting hose are furnished to connect the filter to the oil system.

•

Insulating Compound

TO PROVIDE INSULATION for non-metallic sheath cables, a Vinylite electrical insulating compound is announced by Bakelite Corp, Union Carbide & Carbon Corp, 30 E. 42nd Street, New York 17, N. Y.

Known as VG-9031, this compound is listed by Underwriters' Laboratories as suitable for TW—wet locations—and for Type T and 60 deg oil. The company advises that this compound should make possible TW singles in non-metallic sheath cables.



Absolute Pressure Gage

RECORDING VERY LOW absolute pressure ranges, with corrections for barometric variations said to be inherent, a mechanical-type recording absolute pressure gage has been announced by The Bristol Co, Waterbury 91, Conn. According to the company, this gage embodies a pressure-sealed lever arm so constructed as to be frictionless, free from lost motion, and free of turning moments due to pressure differentials across it.

Series 500 gage is offered in ranges from 0 to 20 mm of mercury and up. This instrument can be used as a remote recorder or an automatic controller of pressure.

•

Hole Digger

FEATURING hydraulic raising, lowering and leveling of derrick, Model PDH-1 hole digger has been announced by Hugh B. Williams Mfg Co, 2946 Oak Lane, Dallas, Texas. Hydraulic system permits operator to adjust derrick for true vertical digging from a truck parked on sloping ground.

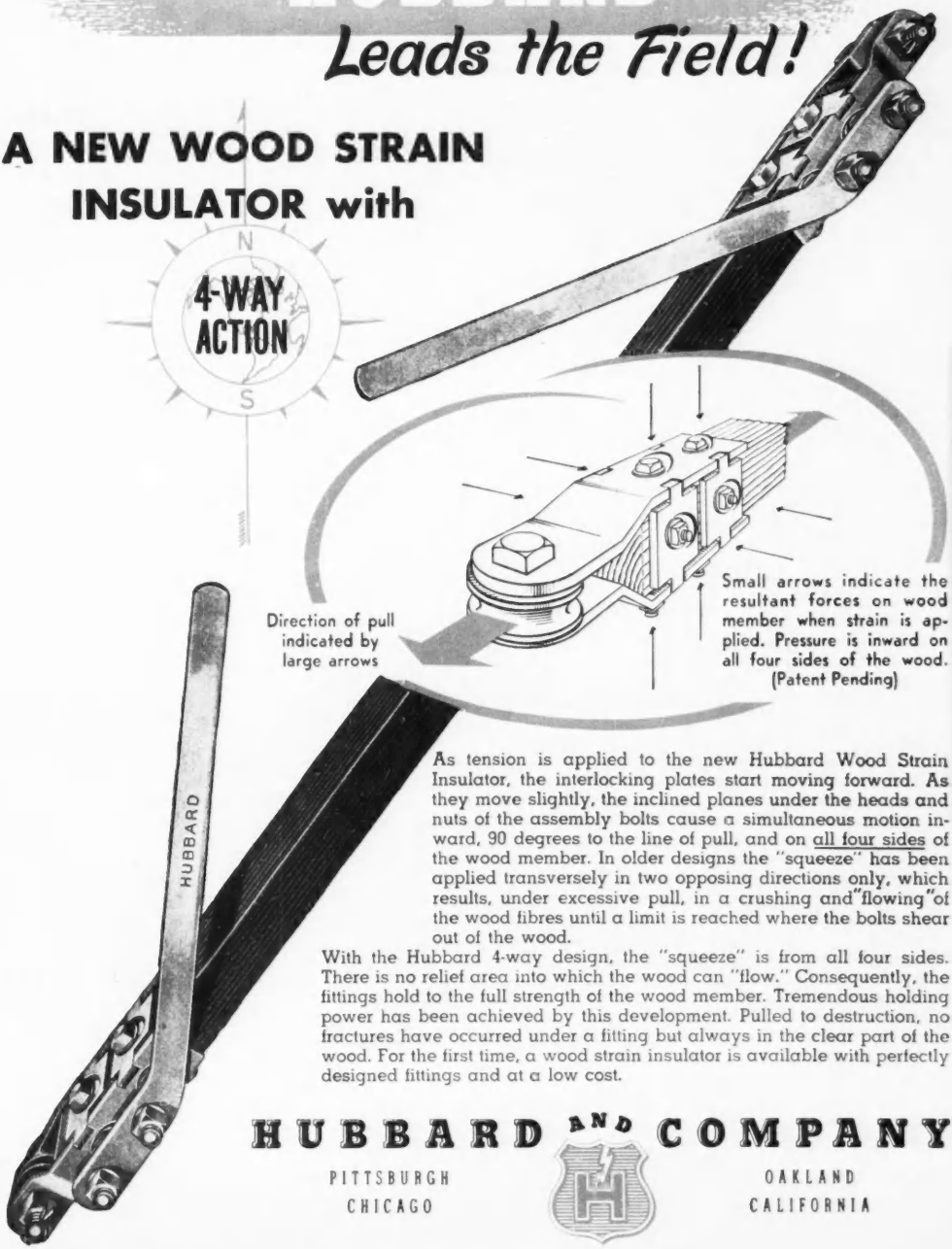
Digger has a reverse mechanism for backing auger out of hole. Standard

Once Again

HUBBARD

Leads the Field!

A NEW WOOD STRAIN INSULATOR with


HUBBARD
Direction of pull indicated by large arrows
Small arrows indicate the resultant forces on wood member when strain is applied. Pressure is inward on all four sides of the wood. (Patent Pending)

As tension is applied to the new Hubbard Wood Strain Insulator, the interlocking plates start moving forward. As they move slightly, the inclined planes under the heads and nuts of the assembly bolts cause a simultaneous motion inward, 90 degrees to the line of pull, and on all four sides of the wood member. In older designs the "squeeze" has been applied transversely in two opposing directions only, which results, under excessive pull, in a crushing and "flowing" of the wood fibres until a limit is reached where the bolts shear out of the wood.

With the Hubbard 4-way design, the "squeeze" is from all four sides. There is no relief area into which the wood can "flow." Consequently, the fittings hold to the full strength of the wood member. Tremendous holding power has been achieved by this development. Pulled to destruction, no fractures have occurred under a fitting but always in the clear part of the wood. For the first time, a wood strain insulator is available with perfectly designed fittings and at a low cost.

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND
CALIFORNIA

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

PROOF

FROM

IOWA

"We no longer purchase conventional transformers"

This testimony of a midwestern operator is backed by his own service records that show "CSP"* Completely Self-Protecting transformers produced these benefits for him:

"lower distribution cost per dollar invested...fewer service trips...better lightning protection . . . fewer transformer burnouts"

Mark this down as sure: complete self-protection *built in* means less dollar investment for distribution facilities. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70522

**Trademark—Reg. U. S. Pat. Off.*

PROVE IT YOURSELF with this new book that lets you compare Completely Self-Protecting transformers with conventional types—using your own figures for original investment, installation maintenance, depreciation and interest. Ask for B-4247, "Transformer Costs and Their Relation to Profits".

Call the Westinghouse Salesman

Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE THREE PHASE BANKED SECONDARY

HOW MANY
would be out of work if you had a transformer fire?

It is not only the transformers, switchgear and perhaps adjacent buildings that go in a transformer fire. Power interruptions and dislocations can be much more serious than immediate property losses.

Your best customers are entitled to insurance against losses due to power failures, especially when you can provide that insurance with nothing more expensive than a Blaw-Knox transformer protection fog system.

Blaw-Knox Fog Nozzles are especially adapted to, and approved for, protection of transformer banks and similar installations.

Blaw-Knox Fire Protection Equipment is listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual Laboratories.

When writing, ask for Bulletin No. 2207

BLAW-KNOX
SPRINKLER DIVISION
of Blaw-Knox Construction Company
829 Beaver Avenue, N. S.
Pittsburgh 12, Pa.
Offices in Principal Cities

models will dig holes 8 to 36 in. diam to depths of 10 to 20 ft. Diggers are also available for holes up to 54 in. in diam.

•

Mobile Radio Equipment

FOR USE BY power companies, heavy construction industries and other in the land-mobile radio service, 25 to 50-Mc mobile radio communication equipment has been developed by General Electric Co, Radio Communication Section, Transmitter Division, Electronics Park, Syracuse, N. Y.

Company advises that equipment exceeds all new FCC regulations and is available for 20-kc or 40-kc channel widths, including 50-w and 250-w station combinations, 30-w and 50-w mobile units, remote control consoles, antenna equipment and accessory items. Equipment consists of loud speaker, microphone with retractable cord, 30 or 50-w transmitter, receiver, antenna cables, control unit and cables.

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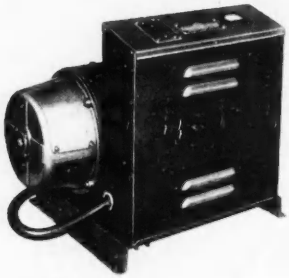


Battery Charger

FOR AUTOMATICALLY CHARGING electrical industrial truck batteries, the KK Charg-O-Matic battery charger has been announced by Hertner Electric Co, 12690 Elmwood Ave N. W., Cleveland, Ohio. Charger is a single circuit motor-generator type and features simplified operation.

Controls are desk high for easy reading and operation. Electrically driven selective time clock switch provides automatic cut-off at end of charging period. Charger will charge one lead-acid battery in eight hours or less and one nickel-alkaline battery in seven hours or less.

•

Hydraulic Tower

HYDRAULIC TELESCOPING towers for truck mounting, which are claimed to have a collapsed height of 10 ft. 3 in. and exceptional platform stability at maximum height, are announced by

H. H. Holan Corp, 4100 W. 150th St, Cleveland, Ohio. Available with stationary, rotary or transverse type platforms, Series HT has electrically controlled tower.

The company reports that all weight is supported by the telescoping box sections. Three models are available—Model 1315 with two sections, extending to a height of 17 ft; Model 1320, with three sections, to 23 ft, 6 in.; and Model 1330, with four sections, to 30 ft.

•

Gas Cable Sheath

FOR USE ON medium-pressure gas cables to overcome weaknesses of the double-lead sheath, a protective sheath covering has been developed by Okonite Co, Passaic, N. J. This covering has a vulcanized 40-mil wall of asbestos-neoprene and neoprene-filled, fungicide-treated cable tape over the single lead sheath. This moisture-tight cushion is reported to be superior to paper tapes.

Over the vulcanized tape are wrapped two 0.005-in. bronze reinforcing tapes, which in turn are sealed within a vulcanized Okosheath protective covering approximately 115 mils thick.

Company claims that this protective sheath is not easily damaged during installation and eliminates galvanic action. This sheath combination can also be used for any lead-sheathed cable where internal pressures cause excessive hoop stress in the lead.

•

Louvered Fixture

FOR A BALANCED distribution of useful light in the critical working zone, an all-steel louvered fixture for commercial applications, Linolite Series 27, has been developed by Frink Corp, 27-01 Bridge Plaza North, Long Island City 1, N. Y. Unit is available for two 10-w T-12 lamps. Light produced in the 0 to 60-deg zone is said to be over

A Typical Submarine Cable (Type 114-PP) Insulated with BAKELITE Polyethylene

Conductor— #8 A.W.G. Stranded
Insulation— Polyethylene 10/64" thick
Concentric conductor— serving of copper wires each .0285" diam.
Polyvinyl chloride plastic jacket— 5/64" thick
Rubber-filled tape
Jute serving
25 galv. steel armor wires— #12 B.W.G.
Jute serving— with tar under and over

DRY AS A BONE!

Here's news about submarine cables! In at least three important installations in different parts of the world—as in a number of laboratory tests—data have been provided which clearly back up predictions as to the overwhelming success of BAKELITE Polyethylene as insulating material for low voltage submarine cables for both salt and fresh water. Not only do conductors remain "dry as a bone," but service-life forecasts are astounding! Some cable has already seen five years' service under the English Channel.

As in other highly successful uses of this newest of the family of BAKELITE Plastics, the usefulness of BAKELITE Polyethylene is based on its unusual combination of properties. Among these are: **Low dielectric constant and power factor. Impact and abrasion resistance. Extremely low rate of water absorption. Inherent flexibility and extensibility over a wide range of temperatures. Light weight (lighter than water). Resistance to alkalies, chemicals, most strong acids. Resistance to water, sunlight, weather.**

Manufacturers and users, alike, are finding that BAKELITE Polyethylene insulation is providing longer, better service, often at lower cost, because of its extraordinary range of chemical, physical, and electrical properties. For complete technical data on BAKELITE Polyethylene—and on VINYLITE Brand Plastics—for insulating wire and cable of virtually every type, write Department GL-28.

Bakelite REG. U.S. PAT. OFF. *Polyethylene* **PLASTICS**

BAKELITE CORPORATION

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

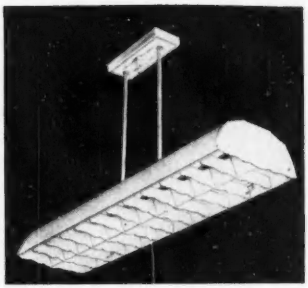
You can do every kind of soldering with this new 250 watt Weller Gun. Power-packed, it handles heavy work with ease—yet the compact, lightweight design makes it equally suited for delicate soldering and getting into tight spots.

Pull the trigger switch and you solder. Release the trigger, and off goes the heat—automatically. No wasted time. No wasted current. No need to unplug the gun between jobs. 'Over and under' position of terminals provides greater visibility with built-in spotlight. Extra 5¼" length and new RIGID-TIP mean real soldering efficiency.

Chisel-shape RIGID-TIP offers more soldering area for faster heat transfer, and new design gives bracing action for heavy jobs. Here you get features not found in any other soldering tool . . . advantages that save hours and dollars. Your Weller Gun pays for itself in a few months. Order from your distributor or write for bulletin direct.

SOLDERING TIPS—get your copy of the new Weller guide to easier, faster soldering—20 pages fully illustrated. Price 10c at your distributor, or order direct.

WELLER
MANUFACTURING COMPANY
817 PACKER STREET • EASTON, PA



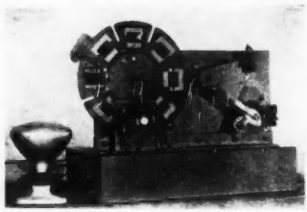
1800 lumens. Distribution is 40% upward and 60% down.

Louvers are held on both sides by loop clips which permit opening louvers from either side. Wiring trough cover is hinged for accessibility to ballasts, wiring and sockets. Unit may be installed on ceiling or stem hanger, individually or in continuous rows.

•

Automatic Projector

FEATURING a projection system which automatically fades one picture out, then fades the next picture in, an automatic slide projector is announced by



Gale Dorothea Mechanisms, 37-61 85th St, Jackson Heights, L. I., New York. Known as the Display King, this projector can be synchronized with lights, sound or mechanical actions.

Projector is produced in 128 basic variations to meet every display, visual education and sales training need. Unit is made in four sizes, two stages of brightness and two focal lengths. It is available with or without coupled dimmer, cased or uncased, and with a choice of two controls—conventional plug-in or remote control.

•

Packaged Speed Drive

FEATURING SUB-ASSEMBLY contruction and easy maintenance, the Mot-O-Trol packaged adjustable speed drive has been announced by Westinghouse Electric Corp. Box 868, Pittsburgh 30, Pa. This drive provides a wide, stepless range of speed control for d-c motors from a-c sources. Unit starts motors, brings them up to a pre-set speed, permits change of speed at any time, applies dynamic braking for stopping, and reverses motors.

Speed may be pre-set before motor is started, or it may be changed after motor has come up to speed. Once speed is set, drive automatically maintains close speed regulation to full speed. It operates from 110/200-v, 50/60-cycle, 1-ph source.

•

High Speed Tachometer

SPEEDS UP TO 17,000 rpm can be accurately measured with an electronic tachometer announced by General Electric Co's Special Products Div, Schenectady 5, N. Y. At speeds up to 4,000 rpm this unit is accurate to 0.1 rpm while over 4000 rpm it indicates faithfully to 1 rpm, according to GE.

Equipment consists of an h-f pulse generator (pick up), an electronic counting circuit, and two indicating units. Tachometer generator weighs about 5 lb and is approximately 6x8x4 in. Counting circuit is housed in a 200-lb cabinet which measured 5x2x 1½ ft. Indicating units are housed in separate cabinets, about 2x2x1½ ft. Indicators have an opal glass screen on which speed is flashed in figures about 1 in. high. Additional information is contained in Publication GEC-560.

•

Combination Fixture

FOR CREATING merchandise displays and "point-of-purchase" advertising, as well as for general illumination, the Val-Lite lighting fixture has been announced by Kent-Moore Organization, Inc (Lighting Division), General Motors Building, Detroit 2, Mich.

Fixture is available in standard models having two or four 40-w fluorescent lamps for single or multiple-unit, continuous strip lighting. Advertising letters are 6 in. high and finished in bright Chinese red. Each letter has two spring steel clips which facilitate moving or changing.

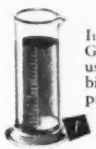
Detachable reflector is finished in baked white enamel. Steel mounting brackets support single or continuous line installations by chandelier suspension. Units are wired for 110-v, 60-cycle, a-c operation only.

How the Alchlor Process makes GULFCREST a superior turbine oil—

1. The Alchlor Process is an extra refining step—weeds out more sludge-forming hydrocarbons than any other refining method.

2. The Alchlor Process imparts a greater ability to benefit from special inhibitors that control oxidation and prevent corrosion.

3. Result: An outstanding oil with long life and unmatched performance records.



In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining most other turbine oils—but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15%—discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:
Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

Case History*

of

Untreated versus Treated Poles

1925	1946
51 Untreated Poles Placed (Northern White Cedar)	19 Poles Still Serviceable
607 Treated Poles Placed (Southern Pine)	600 Poles Still Serviceable

AND *Creosote* MADE THE DIFFERENCE!

In 1946, after 21 years in line—600 out of 607 Pressure-Creosoted Poles were still serviceable. And of the 7 poles no longer in service, 5 had been removed because of a grade crossing clearance—2 because of an accident. *Not a single one* of the 607 poles had been removed because of deterioration due to treatment or preservative failure—a 100% record for creosote.

And when it comes to creosote, you get the best possible delivery service from Koppers. With 14 creosote-producing plants—with 4 large storage plants—Koppers can supply you with creosote *where* you need it—*when* you need it.

Koppers is the nation's largest distributor of creosote. So remember—you can always count on Koppers to help you maintain your production schedules.

KOPPERS COMPANY, INC. · Pittsburgh 19, Pa.

*Proceedings of the American Wood Preservers' Association—1947.

All Standard Specifications
For All Types of Wood Preservation

KOPPERS CREOSOTE...*to be sure*!

MORE NEW PRODUCTS
about which you should know

Burndy Engineering Co, Inc, 107 Bruckner Blvd, New York 54, N. Y., has a hand **splicing tool** called Hytool that cuts wire, strips insulation, and indents Hydent connectors on wires No. 22 through No. 10 . . . Radio Corp of America, RCA Victor Div, Camden, N. J., offers a **blue-screen oscillograph tube**, the RCA-3KP11, which increases the versatility of oscilloscopes now using the 3KP1 tube for photographing electrical phenomena.

Acme Electric Corp, Cuba, N. Y., has developed a portable **voltage regulating instrument** for testing electrical and electronic components and finished products on voltage ranges between 70 and 130 v. . . . Grayhill Co, 4524 W. Madison St, Chicago 24, Ill., has designed Series 5000 miniature **tap-switch** for multi-deck applications; unit is available for 10 or less contact positions per deck rated to break 1 amp at 115 v, a-c.

The Special Products Div, Aerovox Corp, New Bedford, Mass., is now manufacturing a Ballastron, fluorescent lighting power factor **correction ballast** for initial-equipment and existing-equipment uses in three 110-v and three 220-v ratings, with mounting hardware and insulated wire leads. . . . General Switch Corp, 45 Roebling St, Brooklyn 11, N. Y., has announced a weatherproof, externally operated **switch** for outdoor use on buildings requiring a 30-amp capacity service entrance switch combined with four-plug fuse branch circuits.

The General Electric Co, Specialty Transformer and Ballast Div, Schenectady 5, N. Y., has announced an instant-start, 40-w **Tulamp ballast** for operation as low as —20 F. . . . Square D Co, 6060 Rivard St, Detroit 11, Mich., announces three new **safety switch** lines described in Bulletin 3100. . . . The Hilliard Corp, Hiltex Dept, Elmira, N. Y., is now manufacturing Hiltex **oil filtering** material for mineral, heavy-duty, additive and detergent type oils; supplied in 2½ lb batts.

Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass., has announced a **photoelectric counter** Set P-1 for multiple and remote indication, supplied from 115-v, 60-cycle outlet; described in bulletin PA182. . . . Sudar Laboratories, Inc, 306 Halsey St, Newark, N. J., is producing an automatic safety **no blank starter** for fluorescent lamp fixtures which is said to eliminate danger of fire and short circuits.

Trans Inc, 440-445 Gateway Bldg.

Minneapolis 1, Minn., has developed a **gun type saw** for cutting through any material from rubber to stainless steel; stroke is adjustable up to 2 in. and special guides for blade widths from ½ in. to 1 in. are provided. . . . Three Point Industries, 3767 N. Racine Ave, Chicago 13, Ill., has announced a **pipe gage** that indicates exact size of pipe or conduit when placed against it; for pipe or conduit ranging in size from ⅛ to 12 in. inclusive.

Amplex Corp, 111 Water St, Brooklyn 1, N. Y., is manufacturing a universally adjustable **swivel socket** known as Swivelite for supplementary lighting and store and display lighting with capacity of 660 w, 250 v. . . . Mall Tool Co, 7740 S. Chicago Ave, Chicago 19, Ill., has announced new models of the Big 10 **chainsaw**, for all types of cutting, using pneumatic, electric or gasoline engine power.

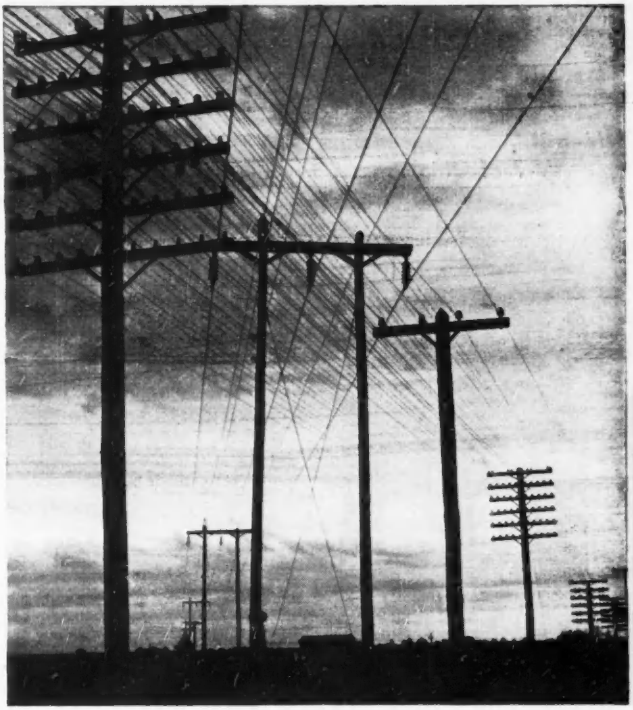
The Leece-Neville Co, 5109 Hamilton Ave, Cleveland 14, Ohio, has introduced a **transformer** for use with both 6 and 12-v Leece-Neville rectified a-c generating systems for automotive vehicles; makes possible the use of standard 110-v a-c tools, lights and other appliances up to 250-w capacity. . . . Allis-Chalmers, Milwaukee, Wis., has announced a **speed limiting device** for use with motors, generators and motor-generator sets adaptable to a speed range from 100 to 2,000 rpm.

Pierce Governor Co, 734 Wabash Ave, Anderson, Ill., has developed a micro-switch centrifugal **governor** for turning off motor, engine or other electrically energized equipment when a predetermined speed limit has been exceeded. . . . Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y., has announced a Eutec-Hand-Omatic **electrode** which is claimed to eliminate fatigue and danger of burning through light gauge materials and to save up to 50% in electrode material.

The Gerin Corp, P. O. Drawer 653, Red Bank, N. J., has announced a portable oil acidity **testing kit** for checking the acidity of transformer, turbine and other mineral oils; test is made with ⅓ oz of oil sample and is said to take about 2 min to complete. . . . Bethlehem Apparatus Co, Front and Depot Sts, Hellertown, Pa., has developed a **mercury cleaning** process for cleaning metal-contaminated mercury for re-use; known as the Bethlehem mercury oxifier, the apparatus handles batches up to 25 lb.

Minnesota Mining and Mfg Co, 900 Fauquier St, St. Paul 6, Minn., has announced a non-sticky electrical **insulating film** for coils known as Scotch-Weld film No. 70 which is applied like tape and then heat-treated; in 60-yd rolls, in widths up to 42 in. and in thicknesses of 2, 4, 6 and 8 mils.

Let the storm come!



KOPPERS

Long-Life Poles and Crossarms

can take it!

THE term "long life" most certainly applies to Koppers Pressure-Creosoted Poles and Crossarms. They last, on the average, more than thirty years, *even under severe climatic conditions.*

Koppers Pressure-Creosoted Poles and Crossarms are protected against decay — the greatest threat to strength and serviceability of wood. Naturally, by installing these strength-retaining, long-lasting poles and crossarms, fewer lines go out of service during storms or at night . . . when replacements are most dangerous and costly . . . when interrupted service is most inconvenient and serious to customers.

KOPPERS COMPANY, INC., **Pittsburgh 19, Pa.**

Deliveries of Koppers Pressure-Creosoted Poles are made promptly from many conveniently located treating plants.

KOPPERS **PRESSURE-CREOSOTED WOOD**

NEWS ABOUT PEOPLE

Merrill Manz Appointed V-P of Ohio Brass Co.

Announcement has been made by the Ohio Brass Co, Mansfield, of three personnel changes. Merrill W. Manz has

MERRILL W. MANZ

been made vice-president; Roger A. Black has been appointed general factory manager; and H. E. Shoemaker, manager, foreign trade department.

Mr Manz became associated with O-B in 1920 as a development engineer in the Mansfield plant. Subsequently he served at the Barberton plant, as director of development at Mansfield, and as manager, steam road sales.

From 1927-31 Mr Manz was manager of the Canadian Ohio Brass Co, in the latter year returning to Barberton a factory manager. In 1935 he went to Mansfield as general factory manager.

Mr Black joined the company in 1930. After spending time in both the Barberton and Mansfield factories he entered the sales department and was sent to the New York office in 1931. Returning to Mansfield as a member of the Foreign Trade Department, he has served as manager of that department since 1932. Mr Shoemaker started in 1934 in the power utilities department. He moved into the foreign trade department in 1935 and returned to that department after discharge from military service in 1946.

•

Herbert G. Johnson has been appointed manager of the heat transfer department, C. H. Wheeler Manufacturing Co, Philadelphia. He will handle the sales engineering of steam condensers, cooling towers, and vacuum equipment. During his 20 years' experience in the power plant field, Mr Johnson has been a consulting engineer, manufacturer's representative and subsequently Philadelphia district manager for the Ross Heater & Mfg. Co.

•

Century Electric Elects Pillsbury Vice-President

Fred H. Pillsbury, executive engineer, has been elected vice-president in charge of operations of the Century Electric Co, St. Louis.

He is the eldest son of Edwin S. Pillsbury, one of the founders of the

FRED H. PILLSBURY

Century Co, and joined the company following graduation from Washington University in 1927. Since then he has served in various departments to gain a wide background in the company's activities.

•

Thorndike Saville, dean of engineering at New York University, has been elected president of the American Society for Engineering Education for the year 1949-50.

C. R. Morey, division manager of Northwestern Public Service Co at Aberdeen, S. D., has retired. Mr Morey has been engaged in the electric and gas utility business since his graduation from Armour Institute of Technology in 1908.

Westinghouse Makes Sales, Engineering Appointments

Appointment of **C. H. Bartlett** as sales manager for the Westinghouse transformer division at Sharon, Pa., has been announced. Mr Bartlett succeeds W. W. Sproul, who has been named sales manager of industrial products for the entire company (EW July 9, p 27).

Mr Bartlett has been active in sales activities since he joined Westinghouse in 1928. After a brief period at East Pittsburgh, he went to Emeryville, Calif, in the transformer sales department.

C. H. BARTLETT

Later, he moved to the transformer sales department in Sharon and in 1944 was made manager of the instrument and specialty department sales section. In 1945 he organized the specialty transformer department and was manager of this department until he was appointed manager of power transformer sales in 1949.

Other recent appointments include the following:

R. L. Brown has been made division engineer in charge of engineering and development of instrument transformers, tap changers, and large power centers for the transformer division in Sharon. He succeeds **J. H. Chiles, Jr.**, who has been made engineering manager for the entire transformer division. For a number of years, Mr Brown has been engaged in the design of large transformers.

W. J. Howell has been named assistant to Tomlinson Fort, manager of apparatus sales. Mr Howell joined the

Daily Steel Deliveries to the Electric Utility Industry

Wherever you are, Ryerson trucks are rolling your way every day . . . speeding shipments of the finest quality steel from nearby Ryerson stocks.

Carbon, alloy and stainless analyses in thousands of shapes, sizes and finishes make up this daily stream of steel. In pounds and tons it flows to your industry from the nationwide network of thirteen big Ryerson plants.

This service cuts purchasing time because one call to Ryerson, one order and one invoice quickly covers a whole group of steel requirements. Do you want one piece or a truckload? You get prompt, personal service either way. Do you want your steel sheared, sawed or slit—burned, bent, punched or threaded? You can be sure of getting quick accurate delivery from your nearby Ryerson plant. So call us next time you need steel from stock. We'll get it to you faster because we're coming your way every day.

PRINCIPAL PRODUCTS

BARS—Carbon & alloy, hot rolled & cold finished

STAINLESS—Allegheny metal plates, sheets, bars, etc.

STRUCTURALS—Channels, angles, beams, etc.

PLATES—Sheared & U. M., Inland 4-Way Floor Plate

TUBING—Seamless & welded mechanical & boiler tubes

SHEETS—Hot & cold rolled, many types & coatings

MACHINERY & TOOLS—For metal working

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI
CLEVELAND • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

Westinghouse graduate student course in 1931 and later was assigned staff duties in the headquarters sales department in Pittsburgh. Since 1941 he has been with the Pacific Coast district.

•

Schmidt Made Assistant to President of I-T-E

Fred Schmidt, formerly president of the Electric Power Equipment Corp, Philadelphia, has joined the I-T-E Cir-

FRED SCHMIDT

cuit Breaker Co, Philadelphia, as assistant to President W. M. Scott, Jr.

Mr Schmidt spent four years in the switchgear division of the General Electric Co before entering the U. S. Navy. After four years in service he joined the Electric Power Equipment Corp in 1945 as chief engineer. He was subsequently made general manager and then president.

In his new executive position, Mr Schmidt will concern himself with the coordination of various sales and engineering activities within the company.

•

Martin R. King has been appointed manager of the General Electric Apparatus Department News Bureau. Assistant manager of the bureau since last spring, Mr King succeeds **C. P. Fischer, Jr.** who has been named manager of a new promotional division, activities of which will be announced later. Mr King has been identified with G E since 1946, when he became identified with the general news bureau of the advertising and publicity dpartment. He remained on the staff for two years and later engaged in editorial and radio advertising work and on special assignments in that department. He was transferred to the apparatus department early this year on special publicity assignments. Before his association with GE, he engaged in newspaper work.

OBITUARY

Arthur P. Good, who held the position of superintendent of the old meter department of the Commonwealth Edison Co, Chicago, at the time of his retirement in 1946, died on July 26. Mr Good was nationally known for his contributions to the promotion of improved wiring methods and the development of modern electrical codes. He had spent nearly 45 years in the service of the Chicago utility. Twice chairman of the old National Electric Light Association wiring committee and twice chairman of the committee on metering and service methods for the Association of Edison Illuminating Companies, Mr Good was also a member of the electrical committee of the National Fire Protection Association, which sponsors the National Electrical Code.

Frederik Borch, head of the electrical engineering department of the Cleveland Electric Illuminating Co, Cleveland, Ohio, when he retired in 1945, died on Aug 15 in that city. Born in Denmark, he received his technical education in that country and Germany, coming to this country in 1906. He joined CEI in 1921 as an electrical engineer and was made senior electrical engineer in 1923. He was appointed assistant superintendent of the engineering department in 1937 and became head of the electrical engineering department in 1942. Mr Borch was a fellow of the American Institute of Electrical Engineers and a member of other technical organizations.

Clayton E. Smith, vice-president of the Torrington division of the Connecticut Power Co, New London, died on July 31. He was 73 years old. Mr Smith had been associated with the Connecticut Power Co and its predecessor, the Torrington Electric Light Co, for many years.

William H. Lawrence, who retired in 1937 as chief operating engineer of the Consolidated Edison Co of New York, Inc, died on Aug 8 in New York, following a month's illness. He was 79 years old. Mr Lawrence was an authority on all phases of electric generation, station installations, electro-dynamics and electrical engineering theories and practices. A native of Middletown, Ohio, he became identified with the old Edison Electric Illuminating Co in 1889. Three years after joining the company he became an assistant superintendent in the operating department, and soon after superintendent. Subsequently he served as superintendent of New York Edison's Waterside electric generating station and became chief operating engineer in 1926. In 1932 he was appointed to this position for both New York Edison and United Electric Light & Power Companies. Mr Lawrence was a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, New York Electrical Society and the Edison Pioneers.

William A. Ross, chairman of the New Brunswick Public Utilities Board, died recently at St John, N. B., Canada, after a brief illness. He was 64 years old. Mr Ross had been named to the chairmanship of the board about six months ago.

George A. Gardner, manager of residential sales, Duquesne Light Co, Pittsburgh, died at his home in Dormont, Pa, on Aug 7. He was 51 years old. Mr Gardner became identified with Duquesne Light in 1919. He had served in the engineering department, commercial department, general sales department and as manager of sales development, of sales promotion and of residential sales, sales and service department. Mr Gardner was a member of the Pennsylvania Electric Association (former chairman of the business development section), the Illuminating Engineering Society, Engineers Society of Western Pennsylvania and the Electric League of Pittsburgh.

Philip F. Davis, a system commercial manager of the Consolidated Edison Co of New York, died on Aug 15 in that city at the age of 46. A native of Ogdensburg, N. Y., Mr Davis became associated with the Northern New York Utilities in Watertown, later joining the New York office of the Niagara Hudson Power Corp. Thereafter he was assistant commercial manager of the Westchester Lighting Co, Mt Vernon, N. Y., and commercial manager of the Utica Gas & Electric Co, Utica, N. Y. Joining Brooklyn Edison Co in 1936, Mr Davis served as commercial manager until he was transferred to Consolidated Edison in 1938 as a system commercial manager. He was placed in charge of the company's commercial center operations.

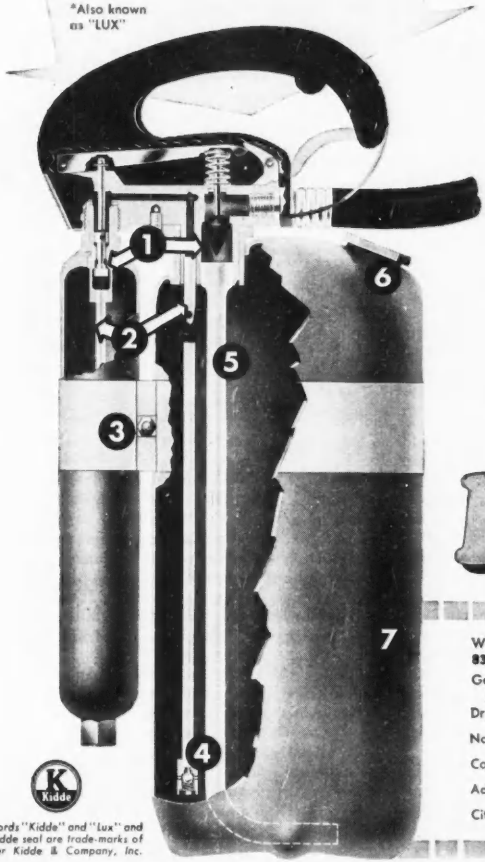
Walter H. Timm, vice-president of the Missouri Utilities Co, Cape Girardeau, Mo, died on Aug 7 in that city at the age of 63. Early associated with the public utility law and regulation field, Mr Timm served on the Wisconsin Railroad Commission and later aided in the organization of the New Hampshire Public Service Commission, serving as secretary and examiner.

A New DRY CHEMICAL EXTINGUISHER WITH Trigger-Finger Control

(nothing new to learn)

Here, at last, is an extinguisher that's designed *right* to make the most effective use of an effective fire-extinguishing agent. Kidde Dry Chemical Extinguishers—made in 20- and 30-pound capacities—are operated simply by pulling a trigger—the same familiar, time-tested method used on all Kidde* carbon dioxide (CO_2) extinguishers.

*Also known as "LUX"



PLUS these 10 other big features

1 *Simultaneous opening of CO_2 and powder valves.* No trapping of gas pressure in powder chamber *before* the discharge starts.

2 *Quicker transfer of pressure to powder chamber.* Siphon tube carries CO_2 to outlet in powder chamber, where it expands to a gas.

3 *CO_2 cartridge easily replaced.* Just loosen name band holding cartridge—then unscrew cartridge. Same size cartridge for both 20- and 30-pound extinguishers.

4 *CO_2 fluffs up powder—prevents packing.* Small port at bottom of CO_2 outlet tube allows gas to stir up powder.

5 *Powder discharges from top through siphon.* No danger of packing at hose connection.

6 *Powder filler cap needs no tools.* Unscrews easily for refilling of extinguishers in the field. Filler cap is safety-vented.

7 *Lightweight cylinder for ease of carrying.* Pound for pound, the *Kidde* Dry Chemical Extinguisher packs more fire-fighting punch!

8 *Better powder dispersion pattern.* Diffusion baffle in horn gives greater coverage, more effective application. No shut-off valve in horn to trap powder under pressure in hose. No rodding out of hose after use.

9 *Extinguisher tested for operation at −40°F.*

10 *Improved powder and packaging.* Powder specially processed to make it free-flowing; packed in weatherproof containers. 30-pound carton contains three 10-pound cans —for easy refilling of either 20- or 30-pound extinguishers. 50-pound containers also available.

Walter Kidde & Company, Inc.
830 Main Street, Belleville 9, N. J.

Kidde

Mail the coupon for full information.

Walter Kidde & Company, Inc.
830 Main Street, Belleville 9, N. J.

Gentlemen:

Please send me further information on the *Kidde* Dry Chemical Extinguisher.

Name.....

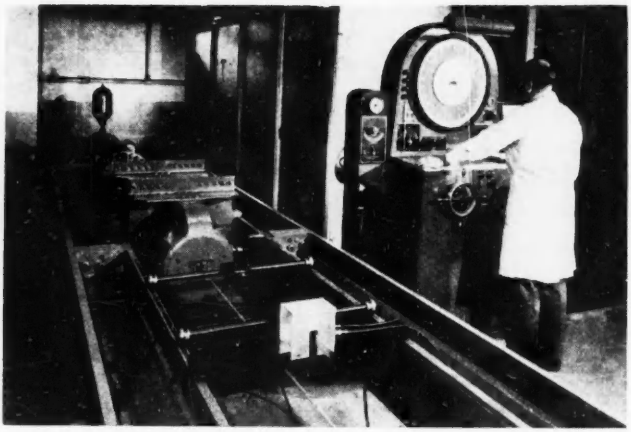
Company.....

Address.....

City.....State.....

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

MANUFACTURERS and MARKETS



CONTROLLING end of the new Baldwin cable testing machine installed by General Cable Corp, Bayonne, N. J. The machine is 74 ft long and is designed for tensile tests of power line conductors with strands of two metals. Loads up to 120,000 lb can be handled

Pole Standards Discussed by Suppliers and REA

A group of western pole suppliers has been conferring with Rural Electrification Administration over its pole selection standards. Upshot apparently will be a slight change in REA's engineering memoranda on the subject, but no alteration of the selection standards.

In conferences with the agency's engineers, pole suppliers from the Montana-Idaho area protested that REA's standards adversely affected sales of lodgepole pine poles. They were particularly concerned over purchases of poles by REA borrowers in the Dakotas.

REA instructions to borrowers caution the latter to study annual costs before buying poles. The agency recommends a formula to ascertain annual cost. In brief, this formula involves the division of the installed cost plus cost of removal by years of life of the pole. This figure is then added to another, arrived at by multiplying installed cost plus removal cost by 0.011, to get annual cost.

REA's pole selection memo backed up this formula by applying it to hypothetical poles of varied costs and life. It was this application to which the pole suppliers particularly objected. REA may drop these cost calculations from the memo, but it is unlikely to change the basic formula.

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Sorg Offers Complete Financial Printing Service

A complete financial and corporate printing service for utilities and manufacturers has been announced by the Sorg Printing Co, Inc, 80 South St, New York 7, N. Y.

The company specializes in printing registration statements, prospectuses, indentures, proxy solicitation material, annual reports, and other periodic financial statements.

Completeness of service is stressed. The company does its own linotyping, hand composition, press work, binding, and distribution in the one building. Most of the year service is available 24 hours a day. Special arrangements can be made for Saturday and Sunday work if a job must be rushed. Trained personnel is available to handle or advise on all financial printing problems. A desk manual containing all the federal securities laws and other regulations of the Securities and Exchange Commission is available.

For out-of-town customers Sorg has hotel space available at all times. Other services include transportation anywhere in the city and air-conditioned, sound-proofed conference rooms.

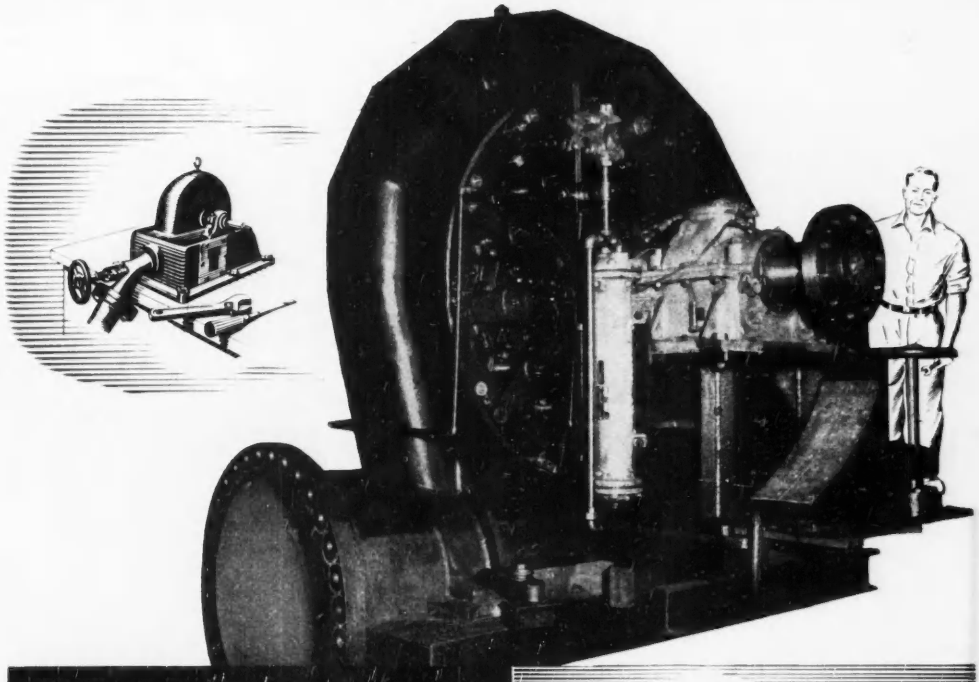
MANUFACTURING BRIEFS

Thirty-eight scholarships and loans, totaling $10,400, have been granted by GE to its employees and their children for undergraduate study in the 1949-50 school year, the company has recently announced.

Approval by the Civil Aeronautics Administration of Rome Cable Corp's RoMarine-Ro-Prene and RoZone-Ro-Prene cables for airport wiring has been announced. CAA's approval covers these cables in single and multiple conductor constructions for voltage ratings from 600 to 5000 v. The first to be approved by CAA for airport wiring, RoMarine-RoPrene and RoZone-Ro-Prene are now included in the Administration's list of approved airport lighting equipment as "Underground Electrical Cables for Airport Lighting" and are available in those sizes and types described in CAA Specification L-824.

Ammunition for their sales promotion programs is being provided Allis-Chalmers motor dealers in the form of a package of aids, which includes a 16½ x 24-in. wall chart, giving clues that can be heard, seen and felt in detecting motor troubles and tips for their correction. In addition to the chart, the package contains "A Handy Guide for Quick Selection of Electric Motors," and "A Guide to Care of Electric Motors."

Signing of the fifth in a series of contracts between the Paulsen-Webber Cordage Corp, New York, and the Government of India for galvanized guy strand has been announced. The new contract for 600 mi of wire will bring the total supplied to approximately 3,100 mi. The equipment is being used in the extensive national electrification



BALDWIN

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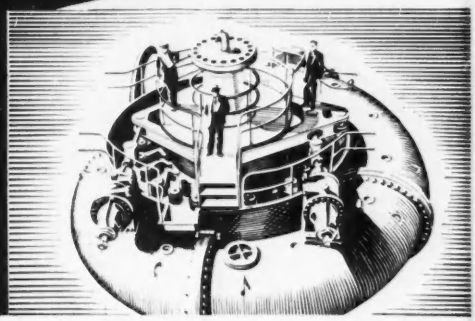
All sizes for all applications



No matter how large or how small a water-power development you are considering—Baldwin can provide a turbine unit to fit!

OUTPUTS. Baldwin is equipped to build turbines in a range from small fractional horsepower water motors up to the largest units that can be shipped.

HEADS. Baldwin can furnish turbines for any required head—from the highest to the lowest.

TYPES provided by the line include impulse, propeller, Francis, and Kaplan (adjustable blade) units.

Baldwin offers a century of sound, practical engineering experience gained in hundreds of previous jobs . . . experience that has helped contribute to the technical progress of an industry, and helped produce some of the most advanced developments in hydraulic turbine equipment.

For a concise, comprehensive picture of the Baldwin turbine line, ask for Bulletin 252. The Baldwin Locomotive Works, Philadelphia 42, Pa. The Pelton Water Wheel Co., 2929 Nineteenth Street, San Francisco, Calif.

The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Boston, New York, Philadelphia, Houston, St. Louis, Chicago, Cleveland, Pittsburgh, San Francisco, Seattle, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.

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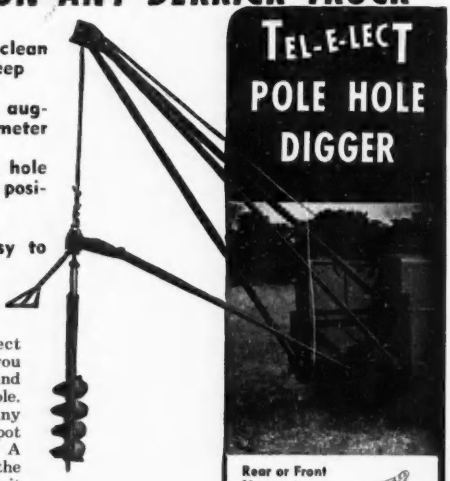
BALDWIN

HYDRAULIC TURBINES

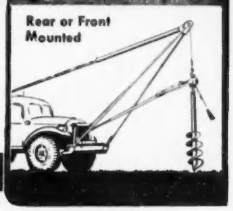
IMPULSE PROPELLER FRANCIS KAPLAN

Operates ON ANY DERRICK TRUCK

- Adjustable for clean holes to 10 ft. deep
- Interchangeable augers 9" to 20" diameter
- Drills a straight hole from any truck position
- Easy to use—easy to transport

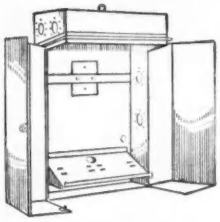


WITH the Tel-E-Lect Pole Hole Digger, you use the same truck and crew that sets the pole. You can drill a hole any place that you can spot the pole derrick. A single bolt attaches the digger to the truck; it works suspended from the derrick. Powered by the truck motor through a power take-off shaft, Tel-E-Lect is raised and lowered by the winch line. Fits the budget of even the smallest utility, and quickly pays for itself. *Ask for circular.*



TEL-E-LECT PRODUCTS, Inc.
9603 MINNETONKA BOULEVARD, MINNEAPOLIS 16, MINNESOTA

KEES Transformer Housing For 4 Transformers



2 CURRENT...
2 POTENTIAL...
No. 3624-14

- Accommodates high insulation types of GE & Westinghouse transformers. ratio 20 to 1, 2300-volt primary.
- Mounting-bar which supports the two current transformers may be attached vertically or horizontally.
- 16-Gauge galvanized sheet steel, welded construction throughout. Doors hinged on both sides, with hold-backs and latch.
- The two potential transformers rest on shelf which slopes to front of housing — gives added clearance, makes installing and replacing easier.
- Knockouts for insulator bushings are spaced to coordinate with current transformers mounted either in vertical or horizontal position.

Manufacturers of Meter Boxes, Pull Fuse Switches,
Meter Test Blocks, Portable Handi-Lites
"SINCE 1874" *Write Dept. EW-2 for Free Catalog*

KEES

F. D. KEES MFG. CO. BEATRICE NEBRASKA

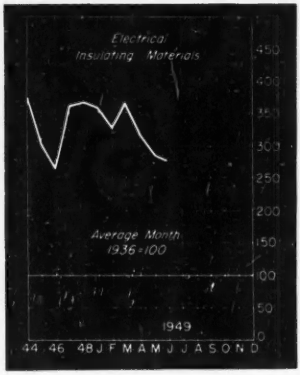
program in India, where a number of large hydroelectric power generating stations are under construction.

Now in active operation in the U.S.A. and Canada is the Cobra Wood Treatment Corp, with offices at 124 East 40th St., New York. The organization was originally chartered under the name, Wood Pole Reimpregnation Co. with offices at 599 Fifth Ave.

•

June Insulating Materials Sales Decline Slightly

Sales billed on electrical insulating materials during the month of June, 1949, dropped slightly from the May



total, according to figures released by the National Electrical Manufacturers Association. The index, compiled by NEMA, moved downward 3 points to 282 from 285, a decrease of 1%.

In June, 1948, the index reached 352, representing 20% over this year.

•

Nife Incorporated Opens Offices in New York

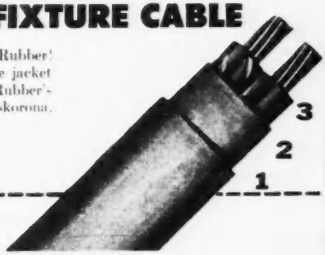
Nife Incorporated has opened offices at 165 Broadway, New York, N. Y., for the distribution of the Nife nickel cadmium storage battery. Nife is stated to be the registered name of the original battery of that type patented by Waldemar Jungner, a Swedish inventor. The battery is reported to have been in use for 40 years.

Nife alkaline storage battery is currently marketed in this country for applications such as train and ship lighting; diesel motor starting; relay tripping in power stations, telephone, radio and television stations and other signalling systems; emergency power sources; portable batteries; hand lamps; and as an electric vehicle power source.

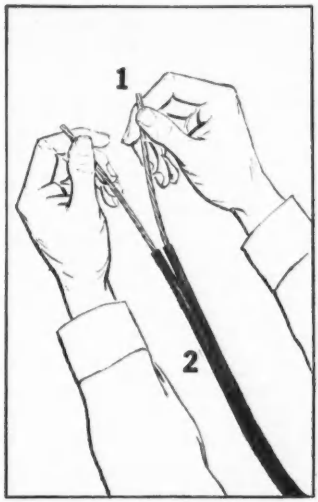
2 Great New "Rough Weather" Cables for Modern Street Lighting

❶ STREET LIGHTING POLE AND FIXTURE CABLE

Here at last is a truly weatherproof cable—and it's made by U. S. Rubber! No festooning, no unravelling or loose ends—thanks to the Neoprene jacket (1) which eliminates fibrous cover. The belt (2) is made of U. S. Rubber's famous Uskorona for extra protection. The insulation (3) is also Uskorona, which is highly resistant to ozone, moisture, heat and cold.

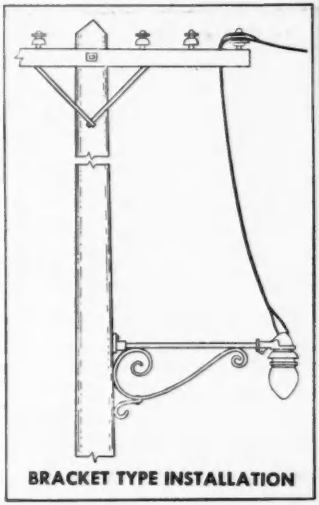


❷ MULTIPLE CIRCUIT "ZIP-CORD" CABLE



Unique construction allows quick separation of conductors by "zipping" the cord.

The Zip-Cord construction (1) makes installations and connections simple and quick on open drops, on series circuits, multiple circuits or secondaries of I.L.'s. Here again this cable will not festoon. The smooth Neoprene cover (2) is specially compounded for rough weather duty. Neoprene makes the wire lighter, smaller in diameter than the ordinary braid construction. The Neoprene cover lasts almost indefinitely even in areas where the weather cycles are extremely severe.



BRACKET TYPE INSTALLATION

For more information write Electrical Wire and Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

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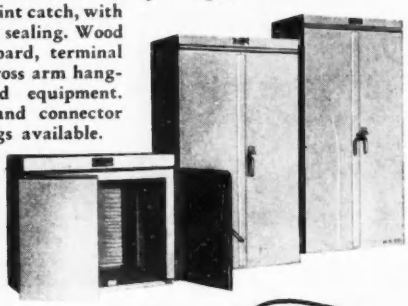

A complete line of Indoor Instrument Transformer Cabinets of code steel, black lacquer finish. Write for bulletins on Meter or Relay Test Switches and Accessories.

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all the U. S. Saving Bonds

you can

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Illinois—M. J. M. Electric Co-operative, Inc., Carlinville, 111.45 mi. rural distr. lines, incl. 66 mi. single phase line and tie lines, and approx. 46 mi. rehabilitation and conversion existing feeders, Jersey, Macoupin and Montgomery Counties, Illinois 40 NR Macoupin, Plans deposit $25. Rural Line Engineers, 440 S. Brentwood Bldg., Clayton, Mo., engrs.

Ia., La Porte—City, power plant imprvs., incl. diesel generating unit, power plant addn., switchboard extens., mis. electrical equip. and wiring. Approx. $75,000. Stanley Eng. Co., Hershey Bldg., Muscatine, engr.

La., New Orleans—Beauregard Electric Corp., De Ridder, brick, tile office, and exten. electrical lines in Allen, Beauregard, Calcasieu and Jefferson Davis Parishes, $935,000. G. C. Hengy & Co., City Bank Bldg., Shreveport, elec. engrs. P. J. W. Purvis, De Ridder, consult. engr.

Mass., Wakefield — Town, Municipal Light Dpt., 9 Albion St., plans by E. M. Bridge, 131 State St., Boston, municipal light plant, North Ave. Approx. $200,000.

Minn., Melrose — Stearns Cooperative Electric Assn., A. Holmgren, Melrose, 1 story, structural and reinforced steel, brick garage and office, $100,000. Plans deposit $15. Long & Thorshov, 100 Metropolitan Life Bldg., Minneapolis, archts. R. D. Thomas & Assoc., 400 Metropolitan Life Bldg., Minneapolis, engrs.

Minn., Rush City—Village, H. L. Sherman, clk., municipal diesel engine electric generating plant with power house, $200,000. Hitchcock & Estabrook, 521 Sexton Bldg., Minneapolis, consult. engrs.

Minn., Wheaton—Village, B. S. Esper, clk., municipal diesel engine electric generating plant with power house, $250,000. Hitchcock & Estabrook, 521 Sexton Bldg., Minneapolis, consult. engrs.

Montana—Northern Electric Co-operative, Opheim, labor only 254.59 mi. rural distr. lines Daniels Valley and Roosevelt Counties, $85,000. State Water Conservation Bd., Helena, engr.

Nebraska—K. R. R. Electric Membership Corp., Bassett, 490 mi. rural distr. lines, Rock, Brown, Cherry and Keya Paha Counties, $500,000. Raymond H. Reed & Co., Columbus, consult. engr.

South Dakota—Central Electric Co-operative, Blunt, 434 mi. rural distr. lines, Hughes Co. $450,000. Scott Eng. Co., Watertown, engr.

Texas—Lower Colorado River Auth., c/o Max Starcke, Austin, electric power transmission lines radiating from Marble Falls Dam and hydro-electric plant, $1,000,000; electric power transmission lines radiating from Granite Shoals Dam and electric power plant, $1,000,000.

Tex., Fort Worth—Beard & Stone Electric Co., Macon and 13 Sts., plans by Wilson & Patterson, 209 Majestic Bldg., 1 story bsmnt., 150x200 ft., brick, tile, stone, granite, rein.-con., steel generator service bldg., air-conditioning, 13 and Macon Sts. $250,000.

Low Bidders & Contracts Awarded

Colorado—Bureau Reclamation, Dpt. interior, Bldg. 1-A, Denver Federal Center, Denver, Olympus and Pole Hill Tunnels and access roads, Estes Park, Foothills Power Aqueduct, Colorado-Big Thompson Proj., Larimer Co., Spec. 2722, to Wunderlich Contg. Co., 206 Patterson Bldg., Omaha, Neb., $4,787,874. Bids 8/2, awarded 8/10.

Georgia—Flint Electric Membership Corp., Reynolds, 215.99 mi. rural distr. lines, Tylor, Schley, Crawford, Talbot, Muscogee, and Marion Counties, to Victory Electric Co., 266 St. Michael St., Mobile,

Ala., $179,156. Bids 8/11.

Iowa—T. I. P. Rural Electric Co-operative, Brooklyn, 287.2 mi. rural distr. lines, Poweshiek Co., to Superior Electric Co., Appleton, Wis., **$339,921.**

Kentucky — Inter-County Electric Co-operative, Danville, 75 mi. rural distr. lines, 2 substations, Boyle, Lincoln, Garrard, Casey, Marion, Madison and Washington Counties, to Real Electric Co., Owensboro, **$92,483.**

Minn., Rochester—State Dpt. Admin., State Capitol, St. Paul, Aug. 9, furnishing, installing at State Hospital, steam generating units, from W. Bros. Boiler & Mfg. Co., 1057 Tenth Ave., S. E., Minneapolis, **$161,980**; turbine generating units and surface condenser, etc., from Worthington Pump & Machinery Corp., 2428 University Ave., St. Paul, **$123,540.**

Nebraska—Twin Valleys Electric Membership Assoc., Cambridge, labor for 143.4 mi. rural distr. lines, Furnas and Harland Counties, to M & M Electric Constr. Co., 7015 Prospect St., Kansas City, Mo., **$71,631.** Bids 6/2.

North Dakota—K. E. M. Electric Co-operative, Linton, 621 mi. rural distr. lines, Emons, Kidder, Logan and McIntosh Counties, to Zontelli Constr. Co., Ironton, Minn., **$596,281.** Bids 7/21.

North Dakota—Tri-County Electric Co-operative, Carrington, Aug. 4, 236 mi. rural distr. lines, Foster Co., from Sorkness Constr. Co., Fargo, **$236,618.**

O., Tiffin—State Dir. Pub. Wks., State Office Bldg., Columbus, power plant for Tiffin State Hospital, to Steinle-Wolfe, Inc., Fremont. Approx. **$183,000.**

S. C., Rock Hill—City, Rock Hill, rural distr. lines, to L. W. Routh Constr. Co., Greensboro, N. C., **$76,198.** Bids 8/5 R. O. Vannort Engineers, Inc., 218 W. 2 St., Charlotte, N. C., engr.

Texas—Comanche County Electric Co-operative, Inc., Comanche, Aug. 9, Sect. 2, 248 mi. rural distr. lines, Comanche, Callahan, Brown and Eastland Counties, from Sisco Electric Co., Conroe, **$250,669.** Est. $250,000.

Wis., Cassville—Dairyland Power Co-operative, John P. Madgett, genl. mgr., Rivoli Bldg., La Crosse, power plant structure, incl., 20,000 kw generator, turbine and boiler house, to F. H. McGraw Co., 48 E. Washington St., Chicago, 1, Ill., **$5,800,000.** Bids 7/21.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Conn., Fairfield—Town, E. H. Staber, chn., Bldg., Comn., brick, steel school, 22 rooms, auditorium, gymnasium, library, science room, health room, etc., Mill Plain School, $7,000,000. Plans deposit $25. Lyons & Mather, 211 State St., Bridgeport, archts.

Tex., Houston—City, City Hall, 900 Brazos St., and Harris Co., Courthouse, plans by Alfred C. Finn, Bankers Mortgage Bldg., 600 to 750 bed charity hospital. **$6,000,000-$7,500,000.** H. Edward Maddox & C. A. Johnson, Buffalo Dr., assoc. archts.

Wash., Seattle—School Dist. 1,810 Dexter Ave., plans by William Mallis, Lyon Bldg., Zone 4, Southwest Junior High School, **$1,500,000**; Rainier Junior School, **$2,000,000**; plans by Jones & Bindon, Hoge Bldg., Zone 4, Van Asselt Grade School, **$700,000.**

Wis., Madison—University of Wisconsin, Madison, plans by Foeller, Schober, Berners, Safford & Jahn, 310 Pine St., Green Bay, Center Bldg., **$3,000,000.** Robert C. Kirchhoff, State Capitol, state archt.

Low Bidders & Contracts Awarded

Ala., Tuskegee—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash. 25, D. C., 100 bed general-medical-surgical hospital addn., to Batson-Cook, West Point, Ga., **$1,167,148.**

Colo., Denver—University of Denver, Bd. Trustees, Denver, general contract seven 3 story, bsmnt., 252 unit, 36 unit each bldg., brick, apartments and 1 story bsmnt., 100x181 ft., concrete, reinforced steel community bldg., to N. G. Petry Constr. Co., 3144 Navajo St., Approx. **$2,245,000.** Bids 4/22.

Ky., Louisville—Veterans Admin., Vermont Ave. between H and I Sts., N.W., Wash. 25, D. C., general contract, general medical surgical hospital, Spec. 4910, to Vignia Eng. Co., Inc., Newport News, Va. **$6,990,000.** Bids 7/19.

THE T.J. Cope INC. REPORTER

Written by Edgar W. Baird, Jr., President, T. J. Cope, Inc., Philadelphia, Pa.

At a regular organization meeting in my office the other day, we were discussing one of our favorite themes—how to reduce costs. One of the boys on our staff suggested that as all COPE products were designed towards labor savings, and thereby cost reducing, it might be a good idea to report some of our conferences to the trade in general. This is the first of those reports in which I hope to point out ways to save real money. So that we can really get together on these topics as though I were sitting right at your desk, I'm going to keep this news-style series of advertisements on a somewhat personal basis—in that way I'll be able to give you more interesting dope than I could in a formal advertisement.

To start off with—and because there is such urgent need for—there is the new COPE PNEUMATIC FISH LINE designed to save you *real* money.

You see it illustrated here. It enables you to fish underground ducts in a matter of minutes rather than hours. One of our customers tells us that he is saving 58 minutes out of each rodding hour.

Only the other day we received a letter from Ed Burke, our Cleveland representative, telling us that the Cleveland Electric Illuminating Company has saved thousands of dollars by using this item. They now need only six men to rod twenty-one conduit runs in a day. Their best previous experience required twelve men who could do only three runs a day. The ratio of improvement: 14 to 1!—Quite a saving.

When we first designed the PNEUMATIC FISH LINE several years ago, the response to it was terrific. Then to make it even more complete, and to further reduce the labor time involved, we included on the Model A the unique feature of a power operated reel. An air turbine is now provided to re-reel the stranded wire, and with this motive power it is now possible to attach various cleaning tools and the winch-line for pulling-in the cable. With this piece of equipment problems have been met and solved that seemed almost impossible with other methods. Ducts as large as 8 inches in diameter and as long as 1,750 feet have been rodded in a few minutes. Compare your problems with this and see where your real economies lie.

I shan't go into design features here because they are outlined fully in our new catalog which you can have for the asking. As a matter of fact, we sincerely invite you to write for this catalog. It describes not only the PNEUMATIC FISH LINE but many other items of money saving cable installation equipment on which we have specialized for more than sixty years.

May I hear from you?

Many thanks.

E. W. Baird Jr.

President

T. J. COPE, Inc.

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for Mid-Atlantic State Electric Utility Company. Experienced in design of transmission lines and/or substations. Permanent position with salary according to qualifications. Applicant please give age, education and experience record.

Write **P-9764**, Electrical World
330 West 42nd Street, New York 18, N. Y.

EXPERIENCED SALESMAN

There's a top sales job in the electrical industry for an experienced salesman with utility engineer and purchasing agent contacts in Wisconsin, Michigan, Illinois and Indiana. Must be E.E. graduate or have equivalent experience.

Excellent opportunity for man in his thirties to grow with one of the most progressive electrical manufacturers in the Midwest.

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Utility Manager or Executive Assistant *Available*

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Wanted by Manufacturer

Experienced man to handle sales correspondence and quotations on distribution and power transformers. Should have pleasing sales personality, be an electrical engineering graduate, and have actual sales experience.

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TRANSFORMER MANUFACTURER

Looking for SALES Representation in Philadelphia Area for sale of Power and Distribution Transformers.

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Well established New England wholesale electrical supplier, modern building, equipment, present volume $375,000, excellent net profit, physical net assets $100,000. Terms reasonable.

BO-9720, Electrical World
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REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

MANAGER FOR Alaska distribution and power generation REA cooperative system. Engineering and previous REA experience desirable. Primary prerequisite competence in distribution, power generation, public relations, executive management. State starting salary requested and when service available. No others need apply. Chugach Electric Association, Box 488, Anchorage, Alaska.

WANTED RELAY Engineer, first class, graduate, for large power system, Southwest. Must have minimum of five years experience in planning, coordinating, testing and repair of modern power system relaying. Furnish photo with experience record. P-9773, Electrical World.

SELLING OPPORTUNITIES OFFERED

REPUTABLE LONG established power switching equipment manufacturer wants experienced sales agents familiar central station and general power applications for Florida, Illinois, Michigan, Missouri, Ohio and Carolinas. Write RW-9565, Electrical World

REPRESENTATIVE WANTED to handle lines of varnished cotton, fiberglass, and extruded plastic, tubings and sleevings; flexible mica sheet, and mica tapes; and porcelain bushings in the state of Ohio. RW-9657, Electrical World.

MANUFACTURERS SALES Representative. If you are calling on electrical and hardware jobbers, add Delayed Action light switches to your line. Protected territory, commission. Balmac Mfg., 3100 Fenton Rd., Flint 3, Mich.

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

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- **COMPRESSORS**
- **PUMPS**

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Prompt guaranteed engineering work on your electrical power equipment by our staff of experienced engineers. Write today.

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Volts	Speed
1250	Al. Ch.		2300/4009	3600
200	G.E.	56947 KF-	2300	1800
500	G.E.	KTP	440	1800
350	West.	CS	2200	900
250	G.E.	IK	2200	900
200	West.	CS	440	720
150	G.E.	TEFC	550	720
100	Al. Ch.	AR	440	514
100	Al. Ch.	AR-SB	2200	1200
750	G.E.	IK	440	720
75	Al. Ch.	AN	440	1200
60	Al. Ch.	AR	440	514
50	West.	CS	2200	900
30	G.E.	KT	440	900
25	Cr.Wh.	118Q	220	1200

SLIPRING MOTORS

3000	G.E.	IM	2200	120
1000	Al. Ch.	ANY	2300	240
800	West.	CW	6600/440	507
750	G.E.	MT-16	2200	450
500	Ideal	AV	2200/4000	1800
400	Al. Ch.	ANY	4000	514
350	G.E.	IP	2300	720
300	Al. Ch.	ANY	2300	720
250	Cr. Wh.		440	600
125	G.E.	IM	2300	720
100	Al. Ch.	ANY	440	720
60	West.	CW	2300	870
30	Lincoln	Crane	440	900
15	Al. Ch.	ARY	440	900
11	West.	CW	440	1100
7½	G.E.	ITC	440	1200

SYNCHRONOUS MOTORS

2100	G.E.	ATI	4600	514
1000	West.		2300	900
800	Cr. Wh.		440	300
500	G.E.	TS	2200	900
150	E.M.		440	240
250	Al. Ch.		2300/4000	720
200	Al. Ch.	PF-100	2300/ 440	360
150	Cr. Wh.		220	720
145	G.E.	ATI	440	900
125	G.E.	TS	440	600
110	G.E.	ATB	2300	900
100	G.E.	ATI	2200	1800
75	G.E.	ATI	220	900
60	G.E.	TS	220	1200
20	Flynn-Wy	15-VRN	440	1200
15	Century		440	1200

D.C. MOTORS—110 VOLTS

H.P.	Make	Type	Speed
125	G.E.	RC-29A	500
55	G.E.	DLC-203A	1000
25	G.E.	RC-32	800
25	Cr. Wh.	CM-251	750
7½	Rel.	REC	1200
5	Sturv.		570
5	G.E.	RC-7	1150
3	G.E.	RC-23B	3450
3	G.E.	B-224	3500
2	G.E.	CVC-111	1100
2	G.E.	RC-25	1150
2	G.E.		1400
2	G.E.	RC-22	3450
2	G.E.	RC	3450
1½	Diehl	C-305	460
1½	Watson	BW-3	550
1½	West.	SK-224	1150
1½	West.	CD	1725
1	Diehl	16	475
1	Elec. M.	E	2500

ADJUSTABLE SPEED D.C.—110 VOLT

H.P.	Make	Type	Speed
60	Sprague	C	500/1500
30	West.	E	615/1230
20	Roth		685/1165
10	G.E.	RC	575/1150
10	N.W.		600/1200
4½	Cr.Wh.	CM-1QIF	580/1740
½	Roth		350/1400

ADJUSTABLE SPEED D.C.—230 VOLT

H.P.	Make	Type	Speed
500	G.E.	MPC	165/330
250	ELD		400/1200
180-230	G.E.	MPC	730/980
175-350	G.E.	MPC	400/800
100	D.C.	Dyn.	200/3500
75	West.	SK	350/450
35	G.E.	C	300/900
30	West.	SA	400/1200
30	G.E.	BP	240/700
30	Sprague	C-60	240/300
30	Tri.	JF	250/750
25	G.E.	RC-16	500/700
25	G.E.	DLC	600/1000
25	G.E.	RC	500/700
25	West.	S-9	550/780
15	G.E.	LC	550/1000
15	G.E.	RC-16	500/700
10	West.	SK-100	460/1600

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Phone CAnal 6-2900

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1—450 HP.—Ridgeway 900 rpm 2200v.
1—125 HP. G.E., 1800 rpm 2300v.
1—100 HP. Whse. 1800 rpm 440v.
1—100 HP. Whse. 1200 rpm 2200-440v.
1— 75 HP. Whse. CS, 1200 rpm, 2200 volts, 3 phase, 60 cycle.
1— 75 HP. 1800 rpm Westinghouse, 440 volt.
1— 75 HP, General Electric Type KT 900 RPM 440 volt.
2—40 HP. G.E., 900 rpm 220v.
40/20 HP. Westinghouse 600/450 44 volt.

MOTORS SLIP RING

1—2500 HP G.E. MT 257 RPM 6600 volt.
2— 150 HP G.E. Type IM 450 RPM 440 volt.
1— 100 HP G.E. Type IM 400 RPM 440 volt.
1— 100 HP G.E. 720 rpm 440v, 25 cy. IM.
75 HP. G.E. 1200 rpm 220v, 60 cy. Vert.
80 HP. West. 900 rpm 2200v, 60 cy. Vert.
50 HP. F.&M. 1800 rpm 220v, 60 cy.

MOTORS—D. C. 230 VOLTS

1—125 HP. G.E. 1800 rpm R.C.
1— 75 HP. 885 rpm General Electric.
1— 50 HP. 700 rpm Crocker-Wheeler.

VARIABLE SPEED—220 VOLTS

1—35 HP. 300/1200 rpm Westinghouse.
1—30 HP. 440/1200 rpm General Electric.
2—25 HP. 650/2200 rpm Westinghouse.
2—25 HP. 300/900 rpm Electric Dynamic.
1—65 HP. 500/1500 rpm General Electric.

MOTOR GEN. SETS

1—1000 KW Westinghouse 275 volt, 720 RPM 4000 volt Syn.
1—1000 KW General Electric 600 volt 514 RPM 4000 Volt Syn.
1—500 KW. G.E. 250v 900 rpm 2300v Syn.
1—500 KW. G.E. 575v 900 rpm 2300v Syn.
1—125 KW. Crocker Wheeler 1200 rpm 125v Generator 2200v S.C. Motor.
1—100 KW. Elect. Mach. 1200 rpm 125v Generator 4150 Syn. Motor.

PLATING GENERATORS

1—1½ KW. G.E. 5/6v with sq. cage mt.
1—12 KW. Hansen Van Winkle 24v 1200 rpm.
20 HP. General Electric KF Motor.
1—3000 Amp. Chandeysson, 6/12v 400 rpm Syn Motor.
1—2500 Amp. ditto.
1—625 KVA West. Reduction Gear Turbo Generator Non-Condensing, 2400v 3 ph 60 cy.

TRANSFORMERS

1—1000 KVA G.E. 3 ph. 4150 volt to 2400 volt.
3— 400 KVA G. E. 6900 V. Pri.—2300 Y. Sec.
3— 300 KVA Pitts. 2300v pri. 115/230v sec.
3— 300 KVA G.E. type H. 2300v pri. 115/230v sec.
3— 150 KVA West. 2200 volt Pri. 240/480 sec.
1— 150 KVA G.E. 2300v 110-220v.
3— 100 KVA G.E. 4150v, 240/480v. Pyranol.
3— 100 KVA G.E. 4150 v 230/460 v Pyranol.
3— 75 KVA Amer. 2400v, pri. 240/480 sec.
6— 50 KVA West. 2300 v. 120/240 v. Inerteen.

ALTERNATORS & SYNCH. MOTORS

1—2500 KVA Westinghouse, Syn. condenser, 720 rpm 2200v with D.C. exciter.
1—320 KVA Allis Chalmers, 450 rpm 480v.
1—240 KVA General Electric ATB, 600 rpm 240v with D.C. exciter.
1—225 KVA 514 rpm 600v Westinghouse.
4—200/100 HP. Whse. 720/360 rpm 4150v.
1—200 HP. General Electric 257 RPM 440 volt.
1—100 HP. G.E. type TS 600 rpm 4400v D.C.
2—150 HP. Allis Chalmers, 380 RPM, 2200 volt.

Complete Line of A.C. and D.C. Motors and Generators

TRANSFORMERS

FOR SALE

10—	1½ KVA Wag	7200—120/240
50—	5 KVA G-E	2300—115/230
6—	5 KVA W-H	13200—120/240
3—	50 KVA W-H	4800/8320Y—120/240
3—	50 KVA Pitts	26400—2300/4000Y
3—	50 KVA G-E	33000—2400/4160Y
3—	75 KVA W-H	230/460—115/230 DRY
3—	100 KVA G-E	11000—2300/4000Y
3—	100 KVA G-E	33000—2300/4000Y
3—	150 KVA L-M	2400/4160Y—120/240
3—	150 KVA G-E	6600—440
3—	150 KVA G-E	22000—2300/4000Y
2—	200 KVA G-E	6900/11950Y—460/230/115
1—	200 KVA G-E	6600/11430Y—2300
3—	200 KVA Mol	7200/12470Y—240/480 25 cyc.
3—	333 KVA G-E	33000—2300/4000Y
1—	400 KVA G-E	132000—120/240

Many other items in stock

TRANSFORMERS

WANTED

Reliable rewind and repair service on all makes of transformers.

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Cincinnati 27, Ohio

The following equipment available for your inspection is offered for sale at the Bryan Light & Water Works:

5—1½" Slate Feeder Panels 90" High 26" Wide complete with 200 Amp. 5000 Volt double throw 4 Pole Oil Circuit Breakers, and dual G.E. Type HA-2 Operating Levers with 3 G.E. Type PQ3 inverse time limit overload relays. 2 0-100 Amp. AC Ammeters and 1 G.E. DS-19 Polyphase watt-hour meter, also 2 200/500 Amp. 5000 Volt Current Transformers, with each feeder panel.

1—Ingersoll-Rand Class "N.E.3" power driven 3 stage plunger piston Straight line Air compressor, overhead cooler type.

1—Hilco Oil Reclaimer Model H-1 Type 500

2—De Laval Transformer Oil Purifier Model 300 300 ft.—3/500,000 7/4/64 8/6 5 K.V. Lead Cable 7652 lbs.— 2/0 Weather proof copper wire (medium hard)

30—Schutte-Koerting spray nozzles & piping

5—2½ K.V.A. West. 2200/4100 220/110 Transformers

15—3 K.V.A. G.E. 2400 240/120 type H. Form N. Transformers.

BOARD OF TRUSTEES OF PUBLIC AFFAIRS
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9—300 KVA West. Pri. 2300 to 13200 Sec. 230 to 2300, 3 Ph. 60 Cy.
3—75 KVA G.E. Pri. 2300 Sec. 230/115, 1 Ph. 60 Cy.
2—150 KVA Elster Pri. 2300/4600 Sec. 230/460 3 Ph. 60 Cy.
3—150 KVA G.E. Pri. 2300/4000Y Sec. 115/230 1 Ph. 60 Cy.
3—100 KVA G.E. Pri. 6900/11950Y Sec. 230/460 1 Ph. 60 Cy.
1—1000 KVA West. Pri. 2300/13200 Sec. 230/2300 3 Ph. 60 Cy.

PARTIAL LISTING — SEND US YOUR INQUIRIES — WE HAVE IT. TRANSFORMERS BUILT TO YOUR SPECIFICATIONS, REPAIRED AND REWOUND.

BUFFALO TRANSFORMER CO.
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FOR SALE—*New*

3 — TRANSFORMERS

WESTINGHOUSE

46 KV, 60 cycle, oil-filled, self-cooled Potential Transformers—2 bushings, full voltage—330/1 turn—38,000/115 V. These transformers never used — original cost $1,001.00. Reasonable offer accepted.

Write Purchasing Department of

RAILWAY and INDUSTRIAL ENGINEERING CO.
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Generator Voltage Regulators

General Electric GDA, Westinghouse Silvertat, Allis-Chalmers Rocking Contact, for AC and DC Generators All Sizes Available for Quick Delivery.

Western Regulator Exchange
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3 PHASE FEEDER VOLTAGE REGULATORS *FOR SALE*

Due to a change in our distribution system we have removed from service and have for sale, 3 General Electric and 5 Westinghouse, 10% buck or boost, 2400 volt, 3 phase feeder voltage regulators. These regulators vary in size from 20 Kv-a to 52 Kv-a and can be purchased for approximately 10% of original cost. If interested, address inquiry to

RUMFORD LIGHT COMPANY
RUMFORD, MAINE
Att: C. T. Maynard, Engineer

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
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APPARATUS EXCHANGE — 120 Wall St., New York 5, N. Y.

Motor Generator Sets—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
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1—1500	G.E.	600	600	2300/4150
1—1500	G.E.	360	275	2300/4600
1—1250	G.E.	600	275	4150
1—1000	Whse.	514	250	4000
1—1000	Cr. Wh.	720	250	2300/4150
1— 800(3ø)	G.E.	1200	120/240	2300
1— 500	G.E.	720	600	2300/4150
1— 500	G.E.	720	125	2200/4400
1— 400	G.E.	720	250	2300
1— 400	G.E.	1200	120/240	440
1— 350	G.E.	1200	125	4150
1— 250	Whse.	1200	250	440
1— 150	Cr. Wh.	1160	250	2300/440
1— 100	G.E.	1170	125	220
1— 100	G.E.	1200	250	2200

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Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

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WANTED TO BUY

3, 333KVA, 1 phase, 60 cycle, 13800 23900Y to 2400 Volt Transformers.

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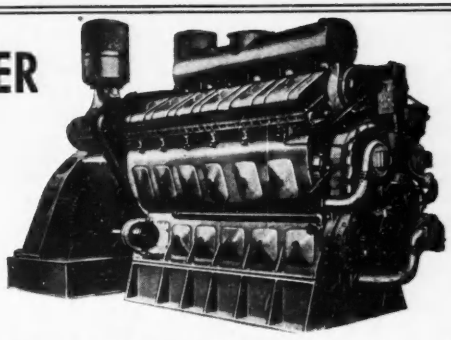
ANY VOLTAGE



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KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	375	Enterprise	DSG-6	450	450
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
1000	General Motors	12-278A	1200	720	187	Ingersoll Rand	S	225	514
937.5	General Motors	12-567	1100	720	125	General Motors	3-268A	150	1200
625	Alco	6-12½x13	750	600	75	General Motors	6043C	90	1200
425	Baldwin	VO-6	510	450	69	Int'l Harvester	UD-18	76	1200

WRITE FOR COMPLETE INFORMATION

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A. G. SCHOONMAKER Company, Inc.

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MOTOR GENERATOR SET

3 Phase to Single Phase

EXCELLENT CONDITION

IMMEDIATE DELIVERY

Westinghouse induction slip ring motor with flywheel, 2500 h.p., 36/60/4600, 720 rpm., ser. 1S14F810, dir. conn. to West. ac. generator 2860 kva., 1/60/440, ser. 1S14F809 with direct mounted West. exciter 25 kw., 250 v., dc, ser. 1S14F811, all starting switch gears, generator, field and exciter panels, 4 brgs.

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Tel. G. M. BOURKE, To 8-5520, Ext. 2819

or Write

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Bought and Sold New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

BANKRUPTCY SALE

The undersigned, Trustee of Davis Transformer Company, Bankrupt, hereby offers for sale all the physical assets of said company consisting of real estate, inventory, machinery, equipment, tools, supplies and office furniture.

Real estate includes land, modern fireproof building and connecting wooden frame building. 45,000 square feet of floor space. Excellent manufacturing location in Concord, New Hampshire. Main line railroad siding with crane facilities.

Equipment includes power hoists, chain falls, complete paint spray including DeVilbers water back booth, air compressors, power shears up to 72" of 18 gauge, oil pumps, drill presses, bake ovens, metal lathes, winding lathes, carpenter shop equipment, Hobart and Lincoln DC Arc Welders, power presses, hack saws, dip tanks, scales, time clocks, complete office equipment with typewriters, calculators, blueprint machines, desks, chairs, fans. Large quantity of fire extinguishers, small tools, hand trucks. Three trucks—Chevrolet, Dodge and G.M.C. tractor and trailer.

Inventory includes all parts for a going electrical transformer business including more than 100 sizes of magnet wire, over 50 sizes of insulated lead wires, approximately 200 sizes and types of insulating materials, new and rebuilt transformers from 2 KVA to 75 KVA, tanks, covers, gauges, switches, arrestors, relays, over 100 sizes and types of porcelain bushings, large quantity of varnish, paint and solvents, large quantities of steel in angle, channel, flats and silicon sheets, copper bars and rods, brass valves, fittings, fuse links, screws, nuts, bolts, and hardware. Many types of welding rod, large quantities of lugs and connectors.

Bids will be accepted on the entire assets of said company or by unit. Copy of inventories may be seen at the office of Ralph E. Langdell, Attorney for the Trustee, 45 Market Street, Manchester, N. H. The property may be shown by appointment. The undersigned reserves the right to reject any and all bids.

B. B. BUTLER, *Trustee in Bankruptcy*
Newport, New Hampshire

LETTERS TO THE EDITOR

Increase Is 7.5c, Not 4.5c

To the Editor of ELECTRICAL WORLD:

In your July 30, 1949 copy of the ELECTRICAL WORLD you carry an article headed "Recent Wage Agreements in Utilities Set Pattern of 5-10¢, 5-10% Boost."

In this article you list the names of several companies and their bargaining union with the amount of increase agreed to by the parties. The Pennsylvania Power & Light Co and the Independent Union is quoted as having agreed to a 4½¢ increase.

I do not know where you received this information, but it is not correct. I wish to inform you that the Employees Independent Association negotiated a new agreement with the PP&L Co, effective June 1, 1949, granting an average of 7.5¢ per hour. The increase was applied to the Salary and Wage Tables by bracketing the amount and was from 4.9¢ to the lower levels to 10.1¢ to the upper brackets. 535 employees received 4.9¢; 2091 employees received 6.93¢; 829 employees received 8.4¢; 733 employees received 10.1¢ per hour—applied to the salary tables. The same kind of bracketing was applied to the 1500 construction employees. The employee who received $1.05 and less received 5¢; up to $1.50 received 7¢; up to $1.69 received 8¢—all employees earning above $41.69 received 10¢ per hr.

I would appreciate it if you would make the correction in your next publication. The Independent Union has met the pattern and is not the low man as you have stated.

John W. Thomas
General Chairman, EIA
Catasauqua, Pa.

Felicitations

To the Editor of ELECTRICAL WORLD:

Was very pleased to receive the 75th Anniversary Number.

As a continuous subscriber to ELECTRICAL WORLD since 1900, I doubly appreciate this 75th Anniversary Number. I still have Volume 39 intact.

On May 1st, after 54 years in the industry, I retired as vice-president of my former company, the Kaministiquia Power Co, Limited (1906-1949), following its absorption by Ontario Hydro.

With every good wish for the continued influence and prosperity of ELECTRICAL WORLD.

W. L. Bird
Fort William, Ont.

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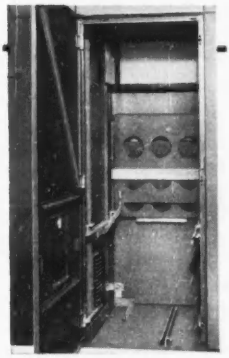
Are You *Really* Interested in Getting More for Your Money?

➽ For years, I-T-E has maintained leadership in the circuit breaker and switchgear industry. Today, I-T-E invites you to look over the special built-in features which have become a part of its "standard price" switchgear . . .



PLANNED FOR BETTER
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PLANNED FOR EASIER
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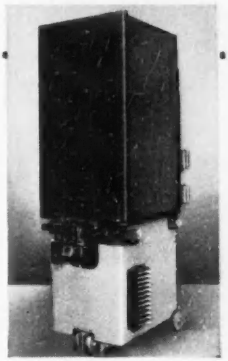

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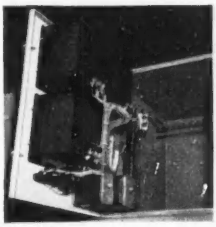
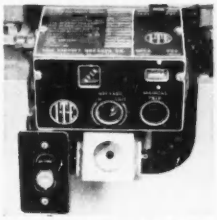


METERS AND RELAYS are mounted on a *Relay Panel* designed for that specific purpose. Why?

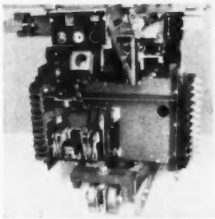
a. Delicate relay mechanisms are not subjected to "operation by vibration" when circuit breaker doors are opened or closed or bumped.

b. The Relay Compartment is just that. The secondary wiring, control bus, and relays are together, *where you want them*, not where manufacturing economy dictates.



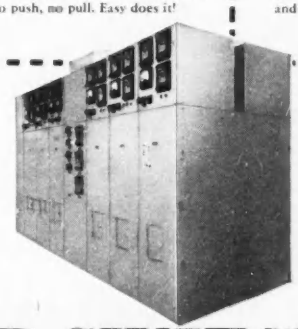
TESTING CIRCUIT BREAKER operation within the structure is no longer a chore.

a. Release a catch, move the breaker 4½ inches, and you are ready to test. An electrical close-trip test-switch is furnished on every breaker unit. Test control circuits are automatically set up. No jumpers, no plugs, no push, no pull. Easy does it!



HIGH IMPULSE CIRCUIT BREAKERS

If you are impulse conscious you are familiar with the present interim test that permits circuit breakers of the 5KV class to be subjected to a 45KV impulse test across the open contacts. Type HV breakers are tested to withstand a 60KV impulse — phase to phase, phase to ground, and across the open contacts.



COORDINATED IN MULTUMITE BOARDS

I-T-E HV MULTUMITE Switchgear assemblies coordinate efficient I-T-E HV Air Circuit Breakers with transformers, meters, bus, and instruments into a single, efficient unit. I-T-E HV Air Circuit Breakers are rated at 5KV, 7.5KV, and 15KV — 600 A., 1200 A., and 2000 A. continuous; 50MVA, 150MVA, and 250MVA interrupting.

These are but a few of our better points. There is an I-T-E Field Application Engineer in your area. Permit him to tell you of other advantages, and to assist in your switchgear planning.

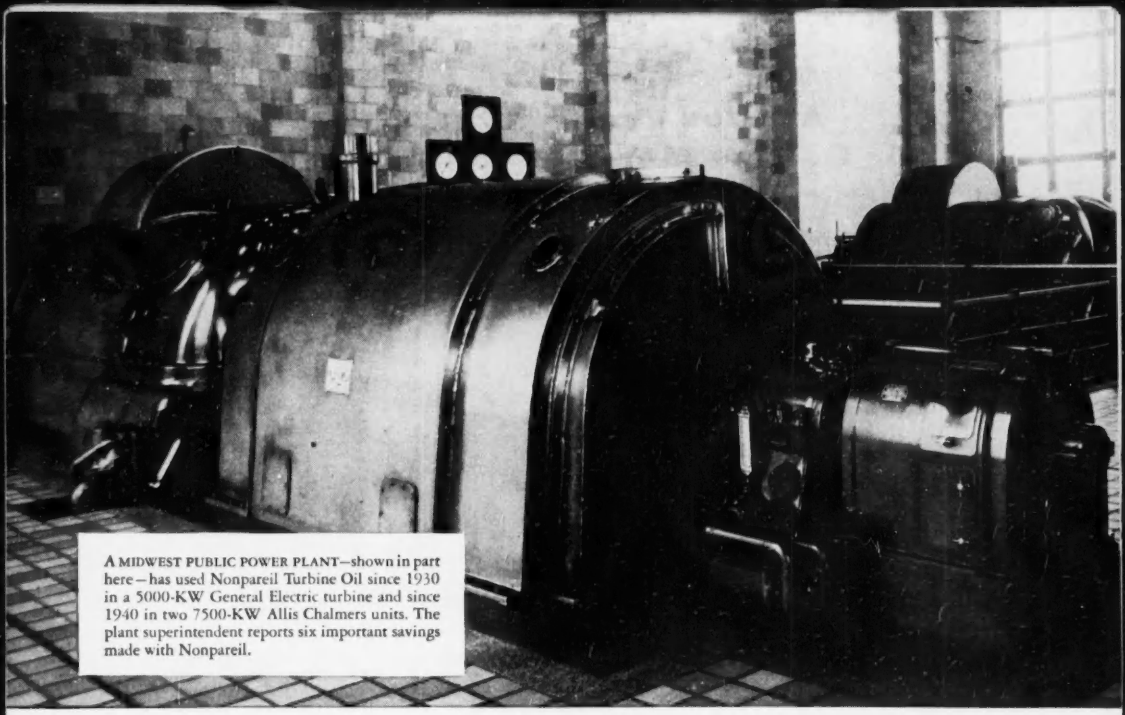
I-T-E R&IE*

POWER SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY, 19th & Hamilton Streets, Philadelphia 30, Pa.
31 Offices in United States · In Canada, EASTERN POWER DEVICES, Ltd., TORONTO
For Export: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • POWER CIRCUIT BREAKERS
MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

* *For power switching equipment refer to Railway & Industrial Engineering, an I-T-E organization*



A MIDWEST PUBLIC POWER PLANT—shown in part here—has used Nonpareil Turbine Oil since 1930 in a 5000-KW General Electric turbine and since 1940 in two 7500-KW Allis Chalmers units. The plant superintendent reports six important savings made with Nonpareil.

Save 6 ways on turbine lubrication

NINETEEN YEARS' service by Nonpareil Turbine Oil has given ample evidence of Nonpareil's great saving ability in a midwest public power plant. The superintendent reports:

1. No oil-replacement fills
2. No extra oil batches
3. No sweetening of oil
4. No oil-treating losses
5. No cleaning of oil systems
6. No repairs due to faulty lubrication

In addition, the superintendent states that the quantity of make-up oil has been held very low—less than an average of 12 gallons per year needed for three turbines.

Why not take advantage of Nonpareil's great saving ability? This unique turbine oil can reduce oil maintenance and lubrication troubles to a rock-bottom low in your plant. Its ability to do this is backed by a written guarantee.

NONPAREIL
Turbine Oil

"Will outlast your turbine"

Nonpareil is the only turbine oil that is guaranteed in writing not to increase in acidity above a neutralization number of 0.15 mg. KOH/gm. That is your insurance against troubles, your assurance of lubrication savings. A Standard Oil Lubrication Engineer will be glad to give you facts and figures from other Nonpareil performance records.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD